# SCIENCE

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# CONTENTS OF VOLUME IX.

## SPECIAL ARTICLES.

# BOOK REVIEWS.



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# LIST OF ILLUSTRATIONS.

# SCIENCE.

*AN ILLUSTRATED JOURNAL PUBLISHED WEEKLY.*

*Vérité sans peur.*

NEW YORK: THE SCIENCE COMPANY.

FRIDAY, JANUARY 7, 1887.


## *COMMENT AND CRITICISM.*

STUDENTS OF THE PROBLEMS of taxation are directing attention to a law imposing progressive taxation, lately passed in canton Vaud, Switzerland, and which will come into operation with the beginning of the new year. The practical working and effects of the law will be closely studied. The project is undoubtedly popular; for when put before the people, as is necessary for the enactment of a law in Switzerland, it was passed by very large majorities. This new Vaudois law divides real property into three classes, according as it falls below \$5,000, between \$5,000 and \$20,000, or over \$20,000 in value. The proportion of tax is to be 1 per 1,000 for the first class, 1½ per 1,000 for the second class, and 2 per 1,000 for the third class. Personal property falls into seven classes, the lowest class being less than \$5,000 in value, and the highest over \$160,000. The rates of taxation on these classes are to be in the proportion of 1, 1½, 2, 2½, 3, 3½, and 4, respectively, per 1,000. Incomes from earnings are similarly put in seven classes; but, in estimating the amount to be taxed, a deduction is made amounting to \$80 for each person legally dependent on the head of the family for his support. A great many theories as to taxation will be put to test by the operation of this law, and its outcome will be watched with interest.

THE SYSTEM WHICH FECHNER deduced from the simple experiments of Weber has had the honor of exciting the criticism of nearly every eminent physiologist and physicist in Germany at one time or another during its brief career. Weber found, that, if you could just distinguish four ounces from five ounces, you could change the ounces to pounds without causing any change in the recognizability of the difference between the two weights. From this, with the aid of some hypotheses, Mr. Fechner deduced the psychophysical law that the sensation is proportional to the logarithm of the excitation. The system has been attacked on every side, and Fechner's last hope is that it will stand, because the attackers cannot agree upon the mode of destroying it. But a consensus is now forming on the mode of attack. Dr. Adolf Elsas, in a recent pamphlet, boldly upholds that the system is unscientific from the root; that it does not follow from Weber's experiments except upon an unjustifiable assumption; and that no system of psychophysics, in Fechner's sense, is physically, mathematically, or philosophically possible. It is possible to state briefly where the confusion came in, viz., in mistaking the sensation of being different for a difference of sensation; but it is not possible to show in a few words how far-reaching the results of this misconception are. If a prediction is allowable, the statement may be hazarded that the outcome of the discussion will be a recognition of a valuable means of gauging the discriminative sensibility of the senses, the avoidance of many current errors in experimentation, and the conviction that it is as impossible to bridge the chasm between thought and nerve by psychophysics as by any other of the numerous methods that have been proposed.

AS WE STATED some time ago, the Kongo Free State has received a severe blow in the loss of the station at Stanley Pool. The official accounts of the affair have just reached us. It appears that the quarrel between Mr. Deane, an Englishman, who, with M. Dubois, commanded at the post, and the Arabs, was about a slave-girl who had sought refuge in the station. Notwithstanding the Arabs' threats, the young Englishman refused to give up the girl. A peace was patched up for the time being; but it was only a ruse on the part of the Arabs. Later they made an unexpected attack, and were repulsed. But soon ammunition ran short. The negro troops at the post took to their boats, and floated down stream to the next station of the association. This was commanded by Lieutenant Coquilhat. He ran up stream to the sta-

tion in his little steamer, only to find it in possession of the Arabs. Mr. Deane was found among some negroes soon after. M. Coquilhat thinks that the situation is quite serious; not, perhaps, so much for its effect upon the immediate prospects of the Kongo Free State, as because it will show the natives that the whites and the Arabs are no longer on good terms. Then, too, it brings the day nearer when the inevitable conflict between the trade association and the slavers must be fought out. It has also closed the route to the lakes *via* the Kongo and Tanganyika.

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But the Kongo State has still an interest in connection with the relieving of Emin Bey, referred to in another column. Mr. Grenfell has ascended a large tributary of the Kongo, which joins the main river about twenty-five miles south of the equator, to a point in longitude east from Greenwich of 19° 40′, and in latitude 4.27°. Dr. Junker passed six years in the Niam-Niam territories. He telegraphs from Zanzibar that on one excursion he followed the Welle to longitude 22° east. These two points are not more than from one hundred and fifty to two hundred miles apart. It may be that the Welle, instead of being a tributary of Lake Tsad, is, after all, a branch of the Kongo. If this proves to be the case, and the river proves also to be navigable, the key to the Soudan may yet be found to be the Kongo railway and river.

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THE ANNUAL REPORT of the directors of the English convict-prisons, drawn up by Sir E. F. DuCane, is interesting, principally because of the valuable statistical tables appended to it. It seems that the number of sentences of penal servitude passed by ordinary courts in England and Wales in 1885 was 1,027, a decrease of 23 per cent as compared with the number so sentenced in the previous year, which, in turn, was lower than any year on record, and only half the number sentenced to penal servitude twenty years before. At the date of the report, the convict-prison population was only 8,183, as against 11,660 in 1869. There is also a remarkable and gratifying decrease in the number of females under sentences of penal servitude. It is now but 821, only a little more than half what it was ten years ago. During the year the commencement of a new work for the war department near Chatham afforded some points of interest in connection with the employment of convict-labor. The report on this reads as follows: "The work in question being quite in the open country, and distant about two miles from the prison at Borstal, special consideration was necessary before deciding that the work could be undertaken. Arrangements were ultimately entered into, which have enabled the convicts to be employed there with complete security. A line of narrow-gauge tramway has been laid down by the royal engineer department along the whole line occupied by the forts under construction, and this is made use of for the conveyance of the convicts to and from their work. A train of railway-carriages, specially fitted to insure the safe custody of the convicts, has been furnished. The site of the works is enclosed by a palisading ten feet high, with a ditch on the inner side, and wire entanglements on the inner side of the ditch. Warders and civil guards travel with the train, and an addition has been made to the armed guard at the works, where a selected officer is always in charge. A system of signals is established between the work and the prison, and an engine is always available in case any thing should be required, or to facilitate inspection by the superior officers of the prison all along the line."

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Sir Edmund DuCane has also something to say about the operation of the separate system, which Pentonville prison was designed especially to carry out. He recalls, that, when the system of separate confinement was decided on, grave doubts were expressed as to whether it could possibly be carried out without injury to the mental and bodily health of the prisoners. At first the isolation and seclusion were very strict, and were imposed upon all prisoners for two years, after which they were removed to Australia. At first the apprehensions of the opponents of the separate system, those who had favored a system of silent or classified association, seemed justified; for it was found that a certain class of minds became enfeebled and lost their balance under the regimen adopted. As the result of this experience, the period of isolation was reduced to nine months, and its strictness was much modified. Since these changes, no evil results have followed; and Sir Edmund DuCane writes, that, "although a complete moral reformation is no longer expected to be the usual result, the separation undoubtedly prevents prisoners mutually contaminating each other, good influences have an opportunity of acting on them, and it has been found of the highest advantage as

a training and discipline preparatory to the subsequent stages of a sentence of penal servitude." At all events, the reform in the system of dealing with crime and criminals has produced such results that the directors find, that, instead of an increasing amount of crime and a swelling prison population, they are enabled, in spite of the increasing population of the country, to diminish the number of convict establishments.

AT THE LAST annual meeting of the British medical association, Dr. Shuttleworth of Lancaster read a paper on 'The relationship of marriages of consanguinity to mental unsoundness,' which has since been published in the *Journal of mental science*. Dr. Shuttleworth states, as evidence that there exists in the public mind a misgiving as to the propriety of such marriages, the fact that he is frequently asked whether any risk attends the marriage of cousins. Numerous contemporary authorities of good repute can be cited on both sides of the question. Dr. Shuttleworth shows that in early times no evil results were feared from the marriage of near kin, and quotes Jeremy Taylor to the effect that "the elder the times were, the more liberty there was of marrying kindred." In studying the history of the lower animals, it is found that "strict confinement to one breed, however valuable or perfect, produces gradual deterioration." Here, then, is the special danger of consanguineous marriages, especially as it seems to be the case that cousin-marriages are more frequent among neurotic than among perfectly healthy stock.

It seems that in 1871 Sir John Lubbock tried to insert a question as to cousin-marriages in the census schedules, but his proposal was rejected amid the scornful laughter of the house of commons as 'the idle curiosity of a speculative philosopher.' In France some attempt has been made to obtain information as to these marriages; and M. Boudin reckons that 0.9 per cent of all the marriages in France are between relations, 0.88 being between first-cousins. Other investigators present different returns, M. Dally contending that in Paris first-cousin marriages amount to 1.4 per cent of all the marriages; and M. Legoyt, chief of the statistical staff, estimates that throughout France first-cousin marriages form from 2.5 to 3 per cent of all marriages. In 1875 Mr. George H. Darwin undertook an elaborate inquiry into the subject in England, and, "by a series of careful mathematical processes, he satisfied himself that in England the proportion of such marriages averages from 1.25 per cent in London to 2.25 per cent in the rural districts for all classes of society, rising somewhat higher in the higher social grades." From this basis, and assuming that first-cousin marriages are not appreciably inferior in fertility to non-consanguineous marriages, Mr. Darwin concluded, that, unless we find in the idiot and lunatic asylums a larger proportion than the above figures would provide for, of children of first-cousins, then no evils, at least so far as mental unsoundness is concerned, can be attributed to first-cousin marriages. In an inquiry based on 4,308 patients, it was found that about 3.4 per cent of the inmates of asylums (5.25 per cent in Scotland) were the children of first-cousins. In Dr. Shuttleworth's own asylum at Lancaster, the record of 100 cases shows 5.1 per cent to be children of consanguineous marriages, and (included in this) 2.8 per cent of first-cousin marriages. The general conclusion seems to be that the propriety of first-cousin marriages must be decided for each case separately as it arises.

MR. STUART C. CUMBERLAND of mind-reading fame gives a very frank and rational account of his doings, in the December issue of the *Nineteenth century*. As a child, his perceptions were unusually keen. But his career as a mind-reader began only six years ago. His first attempt was entirely impromptu, but was as successful as any afterward. The gift was present; and future practice made it only quicker and more delicate, but not more certain. At first Mr. Cumberland frankly confesses he was apt to imagine himself supernaturally endowed, but soon convinced himself that the whole thing is simply an ingenious and skilled interpretation of the unconscious movements of the subject. 'Willing is either dragging or pushing,' is the mind-reader's formula. 'Distinct and intense apperception, fixed attention is incipient motion,' is the psychologist's conclusion.

The account of Mr. Cumberland's experiences with the nobility and eminence of Europe is extremely readable; but some notice of his general conclusions will be of greater interest here. The best subjects are among active brain-workers, statesmen, scientists, etc., where concentration is easy and usual. Military men make excellent subjects;

lawyers are dodgy and unsatisfactory; musicians cannot fix their attention on any thing but music; artists are better subjects; clergymen are perfect in the drawing-room, but not in public; physicians are good subjects when they have no theory about thought-reading. Von Moltke was the best and M. Dumas the worst subject. Englishmen and Germans are perhaps the best races for subjects; while uncivilized races, such as Chinamen and Indians, are bad. Mr. Cumberland's opinion on thought-reading without contact is well worth quoting in full: "Some mystically inclined people claim to be able to read thoughts without contact. For my part, I have never yet seen experiments of this kind successfully performed, unless there had been opportunities for observing some phase of physical indication expressed by the subject, or unless the operator was enabled to gather information from suggestions unconsciously let fall by somebody around. I have on several occasions managed to accomplish tests without actual contact, but I have always been sufficiently near to my 'subject' to receive from him — and to act upon accordingly — any impressions that he physically might convey."

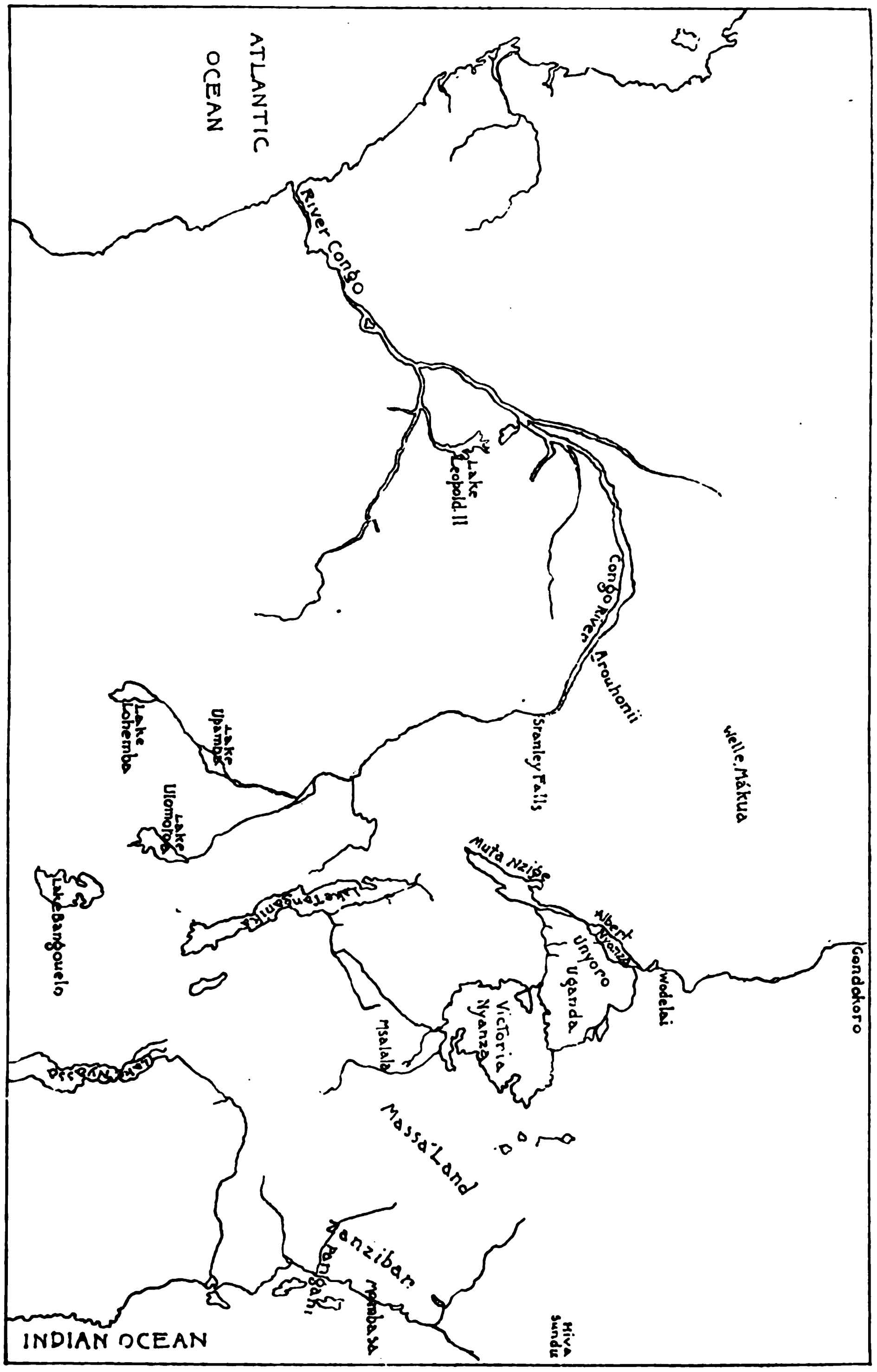
The power is doubtless not an uncommon one, and is closely allied to the knack for reading character, which is quite common, and to the usual processes by which we detect lies and suspicious persons, or avoid being imposed upon. Mr. Cumberland believes that the process might be of actual use in detecting criminals, and once succeeded in doing this himself. The operation of muscle-reading is a very fatiguing one, and the thing is apt to be overdone by amateurs. Mr. Cumberland's experiences are important, because they will aid in divesting these psychic tricks of the mysterious character so commonly ascribed to them, and in directing popular thought into more rational and healthy channels.

## *THE PRISONERS OF THE SOUDAN.*

WHEN General Gordon fell at Khartoom, it was reported that an Egyptian army far up the Nile, commanded by Emin Bey, continued faithful to the khedive. Since then only vague rumors have reached us; and it was generally believed that Emin Bey and his army had long since been overcome by the mahdi, his followers dispersed, and he himself killed. Within the last month, news has been received that Emin Bey is alive, and, though neglected and forgotten by the khedive and his English rulers, is still fighting under the Egyptian flag against the followers of the mahdi.

About ten years ago, Emin Bey, then Dr. Schwitzler of Silesia in Austria, went to Egypt and entered the service of the khedive. He soon acquired the confidence of General Gordon, his commanding officer, and was rapidly promoted, and sent on several important missions into the southern part of Egypt. As a reward for his ability and success, he was made Emin Bey. When General Gordon was sent to the Soudan, Emin Bey was given command of the upper Nile, with headquarters at Lado, near Gondokoro. Here he was stationed when General Gordon was sent the second time to the Soudan. General Gordon was soon after besieged in Khartoom by the mahdi, and his communication both with upper and lower Egypt cut off. Emin Bey gradually retreated with his soldiers and their families up the Nile, fighting as he retired, and defeating the mahdi in several battles, until he made a permanent settlement at Wadelai, on the Nile (not far from Lake Albert), at the extreme southern limit of Egypt. His people are negroes from Nubia and the Soudan. For the last two or three years they have supported themselves by the cultivation of the land. "All the stations are busily employed in agricultural work, and at each one considerable cotton plantations are doing well; this is all the more important for us, as it enables us, to a certain extent, to cover our nakedness. I have also introduced the shoemaker's art, and we now make our own soap," writes Emin Bey.

Emin Bey has but two Europeans with him, — Dr. Junker and Captain Cassati. Dr. Junker is a Russian scientist, and, like his friend and former companion, Dr. Schweinfurth, is a distinguished botanist. Eight or ten years ago he went to Africa, and continued the explorations commenced by Dr. Schweinfurth in the valley of the Bahr-el-Gazel, the western branch of the Nile. He also explored the head waters of the Wellé, — one of the largest tributaries of the Kongo, — and afterwards traced the course of another large river, which Dr. Junker himself believed to be the Arouhuimi. The troops of the mahdi overran the country, and Dr. Junker was forced to retire. By great good luck he succeeded in joining Emin Bey, and has remained with him. The other European with Emin Bey is Gaetano Cassati, formerly a captain in the Italian army. He left Italy in 1879, with several other Italians, and landed upon the east coast of Africa. They spent several years in that part of Africa which the Italians have explored, until his companions were killed and he made a prisoner. He finally escaped, and made his way to Emin Bey at Gondokoro.




SKETCH-MAP, SHOWING PROPOSED ROUTES FOR REACHING EMIN BEY.

At the request of Emin Bey, Dr. Junker with a small caravan left Wadelai for Cairo for the purpose of obtaining aid. Cut off from all communication down the Nile, he was compelled to proceed to Cairo *via* Zanzibar and the Indian Ocean. His route was south through Unyoro and Uganda to Lake Victoria, from there round the western shore of the lake to the English mission, and then east to Zanzibar. Kabrega, the ruler of Unyoro, has befriended Emin Bey, supplying him with food and stores. Moranga, the chief of Uganda, is hostile to Europeans, and may be remembered as the murderer of Bishop Hannington only a year ago. When Moranga heard that Kabrega had assisted Emin Bey, and had received Dr. Junker as his friend, he marched against Kabrega, and defeated him. Dr. Junker with great difficulty escaped, and reached the English mission of Msalla.

On the 8th of October a letter was received from Dr. Junker, dated at Msalla, Aug. 10, in which he pleads for deliverance for Kabrega, succor for Emin Bey, and the reconquest of the Soudan. If Kabrega is not delivered and the Soudan reconquered, the prestige of Europe in central Africa, will, he says, be lost; and if Emin Bey falls, it will be to the eternal shame of Egypt and England. These are the objects of his mission to Europe. He signs his letter, "Your affectionate friend, *disparu et enfin retrouvé*."

As it took Dr. Junker more than six months to reach the English mission, a distance of only three hundred and fifty miles, he must have had much difficulty in passing through Uganda. He left the mission as soon as his caravan was ready, and reached Zanzibar the 20th of December, and expected to arrive at Cairo on the 10th of January, 1887. Thus far, no attempts have been made, either by the English government or the khedive, to relieve Emin Bey; but an expedition under Dr. Fischer, a German naturalist who had spent many years on the coast, was sent out by geological societies of Germany, aided by the German government. It started from Pangani, on the eastern coast of Africa, about fifty or sixty miles north of Zanzibar, in August, 1885. It reached Victoria Nyanza, but, being unable to proceed any farther, returned to Zanzibar last June.

In the early part of the present year, Dr. Oscar Lenz was sent out by the Austrian government to try to reach Emin Bey by the western coast of Africa. He steamed up the river Kongo to Stanley Falls, and left there on the 4th of April, intending to sail up the Kongo to Nyangwé, where Stanley launched his boat in 1877 on his expedition across the Dark Continent. From there Dr. Lenz hoped to cross to Lake Tanganyika, thence by Lake Muta Nziga and the Albert Nyanza to Wadelai. This part of Africa is occupied by Mohammedans, traders in slaves and ivory, who bitterly oppose all explorations that might interfere with the slave-trade. They have recently seized the station of the Kongo Free State at Stanley Falls, and driven the Europeans down the river. It is therefore doubtful whether Dr. Lenz will succeed in passing through this country.

Dr. Joseph Thomson, an Englishman who has spent several years in eastern equatorial Africa, and who commanded the Royal geographical society's expedition through Massai Land to Lake Victoria during 1883 and 1884, offers to head a party to relieve Emin Bey. He proposes to start from Mombassa (a port on the Indian Ocean, 4° north latitude, and 120 miles north of Zanzibar), passing north of Kilimanjaro (a high mountain covered with eternal snows, which Dr. Thomson vainly attempted to ascend, but which has been recently ascended by Mr. H. H. Johnston), through the country of the Massai to Kwa Sundu, on the north-eastern shore of Lake Victoria, thence through Uganda to Wadelai.

Though this route is north of the one taken by Dr. Fischer, yet the general character of the country is the same, and it is inhabited by the tribes of the Massai, a most warlike race. Dr. Thomson succeeded in crossing this territory in 1883, but the people are now more hostile to Europeans, exacting heavier tolls and higher prices for provisions, and frequently robbing and murdering travellers who attempt to pass through. To show the great change in the treatment of Europeans by the negroes, it is only necessary to contrast the account given by Mr. Stanley of Uganda in 1875 and that given by the London *Times* of December, 1886. Mr. Stanley says, "From the time the voyager touches Uganda ground, he is as safe and free from care as though he were in the most civilized state in Europe. He and his are in the hands of Mtesa, emperor of Uganda." The London *Times* says Munga, king of Uganda, "dares to torture and massacre the converts of its missionaries, and an English bishop, without fear or even reproach."

Travelling in central Africa is made by very slow stages. Dr. Thomson did not reach Lake Victoria until one year after his arrival at Zanzibar, and then he had travelled only two-thirds of the way to Wadelai, and that the least difficult part.

It is understood that Stanley has been summoned to Europe to take command of an expedition fitted out by the Egyptian government, un-

der the advice of England, for the relief of Emin Bey. The Belgian papers state that his route will be up the Kongo to Arouhuimi (the tributary referred to above), which empties into the Kongo near the equator, some distance below Stanley Falls. Mr. Stanley, on his last visit to the Kongo, sailed up this river for some distance, and believed it to be the outlet of the Wellé. From the head of navigation on the Arouhuimi, the route is east to Wadelai. Only about two hundred miles are said to be unexplored. The country is inhabited by peaceful negroes, food is easily obtained, and difficulties are less than by the other route.

A cable from England states that Mr. Stanley will sail for Zanzibar, and go directly to Albert Nyanza, through Massai Land; but we may well doubt this information, for although Mr. Stanley, in crossing the Dark Continent, went by Victoria Nyanza, he took a route south of the one now proposed; and he is much better acquainted with the Kongo route. It is possible that Mr. Stanley may sail to Zanzibar, remain there long enough to procure kroomen and porters, and sail with them to the Kongo, and thence up that river to the Arouhuimi.

The need of Emin Bey for relief appears from his letter, dated, Dec. 31, 1885, received in England Oct. 28. This letter brings the only news received[1] from him in three years. He writes that he almost despairs of receiving succor from the north, for he has heard nothing from Cairo or England since April, 1883; that he is without stores and clothing; and that his ammunition is nearly exhausted. With the enthusiasm of a scientific man, he adds that he has worked with ardor at the formation of a grand collection, chiefly zoölogical, including skulls of the different tribes of negroes and of the chimpanzee, skeletons of various animals and two of the Akka of different sexes; and he will endeavor to complete it during his sojourn there. He promises to keep his post as long as possible, trusting, that, if Egypt still governs the Soudan, she must send relief in time. If the Soudan has been abandoned, he will move southward with his troops, until he is relieved by the government or has placed his people in safety. "With the exception of the human skulls, I have saved all my collection, and will not abandon them until the last. Formerly I received two or three times a year letters and newspapers. Alas! it is so no longer. I strive by every means to sustain my own courage and that of my people. God has certainly protected and sustained me hitherto, and I have confidence, that, with his help, all will go well in the future."

He adds, "I have secured for —— a collection of shells from Lake Albert, which I will send by the missionaries at Uganda, and which I hope will reach him safely. — EMIN BEY."

[1] Since this article was written, we have read another letter from Emin Bey, dated July 7, 1886, and then his province was in complete safety and order. These letters show that the necessaries of life are not wanting; but how long he can maintain himself depends upon the strength of the Mohammedan army under the new mahdi on the north, and of the army of the negroes from Uganda on the south.

## STANDARD TIME AND MEASURES.

AT the recent annual meeting of the American metrological society, letters were read from W. F. Allen, secretary of the general time convention, and from Sandford Fleming of Ottawa, Canada, from which, as they contain considerable information, we quote somewhat liberally below.

Mr. Allen stated that he is at present engaged in quite an extensive correspondence with a view to bringing about the adoption of standard time by those cities which still adhere to local time. This movement has already resulted in success in two instances. In Belfast, Me., eastern time was adopted on Dec. 15, 1886, the clocks being set twenty-four minutes slow; and in Pittsburg, Penn., where an ordinance was passed adopting eastern standard time from Jan. 1, 1887, when the clocks were set twenty minutes fast. It is probable that the legislature of Maine will pass a law at its coming session making eastern time the standard for the state. Correspondence with the superintendents of public schools in a number of the cities of Ohio has developed the fact that a strong feeling in favor of the adoption of standard time exists in that state, from which favorable action is likely to come in the near future. The twenty-four o'clock scale is in use upon the Canadian Pacific railway west of Winnipeg, upon the Manitoba and north-western railway, and upon the Idaho division of the Union Pacific railway. It is proposed to adopt it soon on all the divisions of the Union Pacific railway. Under instructions from the general time convention, Mr. Allen is preparing, and will shortly issue, a circular asking the views of the leading railway officials on the subject of the general adoption of this scale for employees' time-tables and advertisements.

Mr. Fleming bore especially on the benefits to be derived from the twenty-four hour system, which has been put in practice on at least two thousand miles of railway. For the past six months the railway stretching from Lake Superior through Canada to the Pacific coast has been operated on the twenty-four hour system. "The towns and villages along the line," writes Mr. Fleming, "have with great unanimity accepted the change, and

not a single voice has been heard in any quarter expressing a desire to return to the old usage. So satisfactory in every way has the new system proved, that the Canadian Pacific railway company have decided to extend its application eastward to Ontario and the valley of the St. Lawrence. The branch and connecting lines are following the same course, and I am assured that by the end of next year the twenty-four hour system will be in common use by the railways from Halifax in Nova Scotia to Vancouver on the Pacific coast. You are, no doubt, already aware that the twenty-four hour system is in use throughout the extensive lines of telegraph between Great Britain, Egypt, India, South Africa, China, and Australia and New Zealand."

However important these changes are, they can only be viewed as provisional steps in the general unification of time throughout the world. They are means to an end, and the great end of the movement may be the universal adoption of a new notation of time which will be common to all nations. It is only step by step, and by familiarizing men's minds with the new ideas, that the larger reform can be accomplished. With this end in view, the Smithsonian institution, desiring to co-operate in the movement, have agreed to publish and circulate, in all countries where their reports are sent, a paper on 'Time-reckoning for the twentieth century.'

"This question," continued Mr. Fleming, "has an educational interest; and, such being the case, much could be done by appealing to the educational institutions. Probably the most effective means of influencing the rising generation of this country would be to bring the subject under the notice of the public schools. If the children of both sexes were taught the true principles of time-reckoning, in a very few years their influence would be felt, and the main obstacle in the way of adopting a common notation would disappear throughout this continent. I venture to suggest, therefore, that the society would in the highest degree advance the important movement by taking such steps as may be deemed necessary and proper, to bring the question to the notice of the superintendents of education in each state with the view of reaching each boy and girl of school age between the two oceans. If America takes the lead in this matter, I do not doubt that the other continents will follow in good time."

The society would be pleased to correspond with any one desiring to use his influence in bringing about the adoption of the metric system, or who is interested in a common method of time-reckoning such as is indicated in Mr. Fleming's letter. The office of the secretary is at Columbia college.

The officers for 1887 are, president, F. A. P. Barnard, president of Columbia college; vice-president, Prof. E. N. Horsford, Cambridge, Mass. recording secretary, Melvil Dewey, librarian Columbia college; corresponding secretary, Alfred Colin, New York; treasurer, Prof. J. K. Rees, Columbia college.

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## *THE NATURALISTS' MEETING AT PHILADELPHIA.*

THE meeting of the Society of naturalists held in Philadelphia during Christmas week was attended by about fifty members, and proved an enjoyable and stimulating gathering. The strict enforcement of the rule limiting membership to persons "who regularly devote a considerable portion of their time to the advancement of natural history," allows only a slow growth to the society, but it insures the illumination of the association by its members, rather than the reverse. Mutual acquaintance is increased; the meetings become as informal as meetings may be; and the naturalist, who has spent a good part of the year too much alone in his own company, finds suggestive intercourse with his fellows. The constitutional object of the society is chiefly the discussion of *methods* of investigation and instruction; for it is held that the announcement of the *results* of investigation finds more fitting and sufficient opportunity in local societies. But in the present day of special investigation there is some danger that the detailed description of methods, useful in their place, and entertaining enough to a few members, may still fail to hold the attention of the meetings as a whole; especially when, as too often appears, the inventive specialist has failed to cultivate the art of presentation.

The day that was devoted to methods of teaching was apparently the most satisfactory to the gathering. H. S. Williams of Cornell spoke on general instruction in geology; Davis of Harvard followed on instruction in geological investigation. In the afternoon, Farlow of Harvard considered the lines profitable for botanical investigation in the United States. Martin of Johns Hopkins discussed collegiate teaching of biology, and Whitman of Milwaukee discribed the proper position of biological investigation in the university. All these papers awakened the meeting to active discussion, and it was decided that the executive committee of the society should consider the advisability and means of publishing the proceedings of the day; for it was generally agreed that both the papers and the discussion that they ex-

cited would be read with profit and encouragement by teachers far and wide. In view of the interest thus awakened, it was suggested that a day be set apart in the meeting a year hence for the discussion of science in the schools. During the session, Professors Leidy and Lesley were added to the list of honorary members, Professors Baird, Dana, and Gray having been previously elected to this class.

## NOTES AND NEWS.

THE lectures delivered by Prof. Rodolfo Lanciani, LL.D., government director of archeological researches at Rome, before the Lowell institute, Boston, are full of interesting and instructive matter. The lecturer, after describing the humble origin of Rome, and the simple matter-of-fact causes which led to its foundation on the Palatine Hill, considered the sanitary conditions of the district which surrounded the new town. During prehistoric times the whole region was volcanic and free from malaria, and when it ceased to be volcanic, then malaria began. The clearest proof of the virulence of malaria in Rome in the first century is afforded by the number of altars and shrines dedicated to the goddess of the fever. At the time of Varro there were not less than three temples of the fever left standing. The principal works of improvement successfully completed in ancient times for the benefit of public health and for checking malaria were: I. The construction of drains; II. The construction of aqueducts; III. The multiplication and paving of roads; IV. The right organization of public cemeteries; V. The drainage and cultivation of the Campagna; VI. The organization of medical help. Professor Lanciani developed fully these points; and we regret, that, owing to want of space, we cannot follow him more minutely. The lectures are unique, and worthy reproduction in a permanent form.

— Physicians will doubtless remember the case of the late Dr. Groux of Brooklyn, who had the power of stopping the action of the heart at pleasure. Dr. Lydston of Chicago, in a note to the *American practitioner and news*, claims to have the same power, and to have demonstrated it to members of the medical profession.

— At a recent meeting of the Society of arts, Capt. Douglas Galton, chairman of the council, delivered an address which was a retrospect of the progress made in sanitation by the English nation during the reign of Queen Victoria. The registration of births, marriages, and deaths came into operation in 1837, ten days after the queen's accession to the throne. The sanitary condition of the country was wretched at this time. One-tenth of the population of Manchester, and one-seventh of that of Liverpool, lived in cellars. In 1845 a chapel in the immediate neighborhood of Lincoln's-Inn Fields was used as a schoolroom in the day-time, and a dancing-saloon at night. In the cellars underneath this chapel ten thousand bodies had been buried in the seventeen years ending 1840, the burials were still continuing, and the old coffins were removed through a contiguous sewer to make room for new ones. In the rural districts the same neglect of the public health was also prevalent. The various acts which have been passed during these fifty years have contributed greatly to the welfare and prosperity of England as a nation. In the decade 1850–60 the annual average saving of lives in England and Wales from sanitary improvement was 7,789; 1860–70, it rose to 10,481; 1870–80, it was 48,443; and in the five years 1880–84, the average annual number of lives saved by sanitary improvements has been 102,240.

— Mr. E. D. Preston of the U. S. coast and geodetic survey left last week for the Sandwich Islands on an important mission for that government. The object of his visit is the determination of astronomical latitudes on these islands, fifteen stations having already been decided upon. The pendulum will be swung at a great elevation, and also at the sea-level, to determine the downward attraction of some of the principal mountains. The latitude stations will be on the following islands: Kauai, Oahu, Molokai, Maui, and Hawaii. The work will probably show great deflections of the plumb-line on all the islands, and the pendulum work will no doubt confirm previous experiments on island stations; viz., that islands give an excess of gravity. The observations will occupy about four or five months. A copy of all observations will be deposited in the coast and geodetic survey archives. The work is done entirely at the expense of the Hawaiian government, the coast survey loaning the necessary instruments.

— Congressman Hatch, chairman of the house committee on agriculture, has received from Commissioner Colman of the agricultural department a reply to the resolution offered by Mr. Swinburne of New York regarding the cause and extent of pleuro-pneumonia in cattle. The commissioner sets forth the difficulties met in the attempt to extirpate or control this disease in the present state of the law, and with the machinery at hand, and re-enforces his recommendations previously made for more heroic methods. The commissioner again recommends as the only measure

which will extirpate the plague, and prevent both the direct and indirect losses, that, wherever an infected herd is discovered, all exposed animals should be slaughtered, the premises thoroughly disinfected, and the owner compensated for the loss to which he is subjected for the protection of the public. He urges upon congress the necessity of legislation giving to the departments power to carry out the measures required for extirpating pleuro-pneumonia untrammelled by state laws or state authorities, and it is expected to promptly suppress this disease.

— W. Stainton Moses, lately a vice-president and a member of the council of the English society for psychical research, has withdrawn from the society. In his letter of resignation, Mr. Moses says, "I have concluded, that, as a representative spiritualist, I could not do otherwise. considering, as I do, that the evidence for phenomena of the genuine character of which I and many others have satisfied ourselves beyond doubt, is not being properly entertained or fairly treated by the Society for psychical research."

— Professor Rohé of Baltimore, in a paper read at the last meeting of the American medical association, recommended that instruction in cookery be made a part of the curriculum of the public schools, and that mental philosophy or trigonometry should be dropped in order to make a place for it. In a number of schools and seminaries throughout the country the art of cooking is taught. In Lasell seminary at Auburndale, Mass., it has been taught since 1877. The Boston cooking-school was started in the same year. Similar schools are in operation in Raleigh, N.C.; Staunton, Va., and Washington, D.C. In London practical lessons in cookery are given in the girls' common schools. In Boston, Mr. Hemmenway of that city has succeeded in persuading the members of the school board to make instruction in cookery a part of the regular system of instruction.

— Mr. J. W. Walker has discovered on the south side of Pine Mountain, Georgia, nearly two hundred feet above the famous corundum-mine, a site where the ancient inhabitants of that region manufactured their talc vessels for cooking. Evidences of the use of stone implements in the work are indubitable. The vessels were blocked out and hollowed before being broken from the ledge. Many of the remaining fragments are honey-combed by exposure for a long time. Archeologists are familiar with similar phenomena elsewhere. Dr. Rau of the Smithsonian institution mentions several sites in the District of Columbia, and Paul Schumacher gives an elaborate account of the working of such quarries in southern California (Wheeler's *Report on U. S. geog. surv. west of 100th merid.*, vii. 117–121). Dr. Abbott's paper in the same volume (pp. 93–116) should also be consulted.

— On Nov. 10, 1886, a meeting of intercolonial delegates was held at the Royal society's rooms, Sydney, for the purpose of forming an Australasian association for the advancement of science. The following delegates were present: — Victoria: Field naturalists' club of Victoria, the Rev. Dr. Woolls; Geological society of Australasia, and Historical society of Australasia, Mr. R. T. Litton; Royal society of Victoria, Mr. K. L. Murray; Victorian institute of surveyors, Messrs. W. J. Conder and W. H. Nash; Victorian engineering association, Professor Kernot and Mr. K. L. Murray. Queensland: Geographical society of Australasia, Queensland branch, Mr. J. P. Thompson; Royal society of Queensland, Mr. Henry Tryon. Tasmania: Mr. James Barnard. New Zealand: Philosophical institute of Canterbury, Mr. S. Herbert Cox. New South Wales: Linnean society of New South Wales, Professor Stephen; Royal society of New South Wales, Mr. H. C. Russell, Professor Liversidge, Mr. C. S. Wilkinson; New South Wales zoölogical society, Dr. A. T. Holroyd; Sydney branch of the Geographical society of Australasia, Sir Edward Strickland. In the absence of Mr. C. Rolleston, president of the Royal society, Mr. Russell was voted to the chair. The first election of officers will be held in Sydney in March, 1888, and the first meeting of the association in the first week in September, 1888. Professor Liversidge was appointed convener for the next meeting, and a hearty vote of thanks was accorded to that gentleman for the part he had taken towards the formation of the new association, general satisfaction being manifested at the successful result of the meeting.

— Mrs. Thomas Say, the widow of the well-known naturalist who has been dead over fifty years, died at Lexington, Mass., on Nov. 15 last.

— Our Vienna correspondent writes us, "I was recently present at the trials made with a new pistol invented by Mr. Marcus, a distinguished mechanical engineer. In this invention the use of a cartridge is dispensed with, the bullet itself being prepared with an explosive. But, in spite of this explosive nature of the bullet, its shape is not altered by the explosion. The explosion is initiated by a simple mechanism provided in the interior of the pistol. The experiments were made with a single-barrel pistolet (the barrel being four centimetres long, and its caliber six millimetres). At a range of thirty paces a three-quarter-inch thick wooden board was pierced by

the bullet. Then a pistol with a simple-acting magazine, containing twelve bullets, was tried, allowing to give off forty shots per minute."

— Baltimore is about to build a crematory modelled after that of Buffalo.

— From the *Medical and surgical reporter* we learn, that, among the recruits recognized as unfit for military service in Switzerland in 1885, were 66 per cent of the tobacco-workers, 67 per cent of the basket-makers, 60 per cent of the tailors, 25 per cent of the butchers, and 25 per cent of the stonemasons and carpenters. Of 6,154 recruits in canton Berne, 1,833 were refused; of these, 581 suffered from goitre, and 162 from flat-foot.

— The Abbé Laflamme, of the University Laval, Quebec, has presented a note to the Royal society of Canada ('Memoirs,' 1886) on the contact of the paleozoic and archean formations in his province. Numerous exposures were examined, and in nearly all of them the Trenton limestone was found resting immediately on the clean, firm, rather smooth surface of the gneiss, without transitional deposits. Fragments of the crystalline rocks in the stratified are seldom found. The limestone beds follow the irregularities of their foundation, mantling over the mounds, and descending into the hollows. At certain points a sandstone lies on the crystallines: this is regarded as a time-equivalent of the Trenton, owing its composition to local geographic control not felt elsewhere. The change from the Trenton limestone to the overlying Utica slates is described as abrupt, without traces of gradual transition.

— The Franklin institute of Philadelphia has recently determined to attempt the formation of a state weather-service for Pennsylvania on the plan generally pursued by these organizations. The offer of the chief signal officer to furnish a member of the signal corps to assist in the work is accepted, and the legislature is to be petitioned for an appropriation of three thousand dollars for instruments and publications. The chairman of the committee in charge of the matter is Mr. W. P. Tatham, who should be addressed, in care of the Franklin institute, Philadelphia, by volunteer observers in Pennsylvania qualified for the work proposed.

— An account of the hurricane of March 3 and 4, 1886, over the Fiji Islands, was read at a recent meeting of the Royal meteorological society in London, by Mr. R. L. Holmes. This storm was the most destructive that has ever been known to occur in the Fiji group. The lowest barometer reading was 27.54 inches at Vuna, in Taviuni. The storm was accompanied by a great wave from 18 to 30 feet in height, which swept over the land, and caused an immense amount of damage. It was reported that 50 vessels were wrecked, and 64 lives lost, during this hurricane.

— The state board of health of Pennsylvania has issued its first annual report. It includes reports on the pollution of the Schuylkill River, the sanitary condition of Harrisburg, a detailed account of the typhoid-fever epidemic at Plymouth. In this famous epidemic there were 1,153 cases of sickness, with 114 deaths, and an expense of $97,-120.25. A description of the disinfection apparatus employed at the municipal hospital of Philadelphia is also given.

— The ninth biennial report of the state board of health of California has just been issued. For the year ending June 30, 1885, there were 8,238 deaths recorded in the state: 1,227 deaths occurred from consumption. The rate from this cause is but little less than that of Massachusetts.

— The state board of health of Massachusetts has issued a manual containing the statutes of that state relating to the public health, and the decisions of the supreme court relating to the same.

— A wood-turner of San Francisco died ten days after receiving an injury to the brain which was not discovered until several days afterward. While at work at his trade, a steel chisel became detached from a grooving-machine, and struck him in the head, producing a fracture of the bones of the nose, and severely injuring the left eye, so seriously as to destroy that organ and necessitate its removal. After the removal of the eye, the surgeons found behind it a piece of steel three and a half inches long, one inch wide at the centre, and tapering to sharp points at the ends. One end was buried one inch and a half in the brain. The velocity and force with which this chisel must have entered the brain may be imagined when it is stated that the drum to which it was attached was making twenty-three hundred revolutions a minute.

√ — A correspondent of the *Medical press* writes from Berlin that the toxic qualities of the cholera bacillus have been investigated by Professor Cantani of Naples. He claims that the poison may be due to ptomaines, to the secretions of the bacilli, or to the bacilli themselves. Experiments made on dogs lead him to incline toward the last theory. Pure cholera cultures in beef-tea sterilized by heating to 100° C., injected into the dog's peritoneum, produced all the symptoms of cholera-poisoning; while pure beef-tea, injected in the

same manner, left the animals in perfect health. This certainly would demonstrate toxic qualities for the dead bacilli when absorbed by the living body.

— Dr. McEachran, live-stock inspector for Canada, is opposed to the inoculation of cattle for the prevention of pleuro-pneumonia. He believes, that, in every country in the world where it has been impartially tried and reported on, the report has been unfavorable. He regards it as a dangerous operation, and not warranted by any known benefits. Many die from the operation itself, and wherever it is practised it has to be kept up. Thus in Scotland, where inoculation is practised, there is a constant supply of the virus; and the cities of Glasgow and Edinburgh are active centres of the disease.

— The recently held meeting of the French congress of surgeons was a very notable one. M. Ollier of Lyons, well known for his experiments in bone-grafting, presided at the meeting, which was attended by many of the most eminent surgeons of France, as well as by other men of note, among whom were the president of the senate and the rector of the university. The most interesting discussion was that in regard to tetanus, or, as it is commonly called, lockjaw. It was opened by M. Vaslin of Angers. He regards it as a purely nervous disease, and, in support of his views, narrated a case which had come under his own observation, in which the disease was due solely to emotional causes, and which was cured by chloral and morphine. Professor Balestreri of Genoa concurred with M. Vaslin, and related several cases which he had treated, and which were successful. Professor Thirier of Brussels, on the other hand, believed tetanus to be contagious and of a parasitic nature. M. Mannoury of Chartres denied its contagiousness, and said, that, after conferring with a good many veterinarians, he was unable to learn of a single case in which the disease was communicated from one animal to another. Professor Verneuil of Paris is a firm believer in the contagiousness of tetanus, and thinks that it can be contracted by man from the horse. He said that human beings are often attacked with tetanus when living with or near animals affected with the disease, and that it often follows horse-bites. Wounds which have in any way come in contact with earth or straw soiled by horses are more liable to be accompanied by tetanus than others; and the disease is most frequent among stable-boys, horse-dealers, and, in general, those whose duties bring them in contact with horses. Notwithstanding all these arguments, it was generally admitted that all attempts to convey the disease experimentally from an affected animal to a healthy one had failed. M. Blanc of Bombay thought the disease to be contagious, and communicated sometimes through infected water. Interesting papers were read on bone-grafting, and the uniting of divided nerves by suturing. The author of the latter paper believed that severed nerves may be made to unite in a few hours.

— The sermons and autobiography of Mark Pattison, late master of Lincoln college, Oxford, excited such general interest, that arrangements are making to publish a volume of selections from Mr. Pattison's miscellaneous writings.

## *LETTERS TO THE EDITOR.*

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Polarization of resistance coils.

IN August last Professor Mendenhall, in conversation with the writer, alluded to his observation of the polarization of certain resistance coils, and suggested an examination of the coils in this laboratory. The examination was made, and the results stated in remarks upon Professor Mendenhall's paper at the Buffalo meeting of the American association. A brief account may not be without interest and value.

The idea entertained by Professor Mendenhall at the time seemed to be that the polarization was of a 'statical' nature; the deflection obtained on connecting the coil, through which a current had been passed, with a galvanometer, being produced by the 'residual charge.' The examination of our coils was undertaken with the same idea, the 'condenser discharge' method being made use of, substituting the coil under trial for the condenser. The galvanometer was a 6,000 ohm astatic Thomson, by Elliott Brothers, its needle making a vibration in about ten seconds. A Fuller cell and Sabine discharge key were used. Polarization was found in every coil in the laboratory, except in a standard B.A. unit from Elliott Brothers. It was also found in a Hartmann box loaned for examination by Messrs. Queen & Co. The effect was found to vary widely in different coils in the same box, particularly so in a box of 100,000 units from Elliott's, whose 40,000 coil gave 40 degrees deflection against 6 or 7 degrees for any other coil in the box. On opening the box, it was found that the 40,000 coil had been heated till the paraffine had melted and some of it had run off, while the other coils were well covered, as usual in Elliott coils. The Hartmann box, whose coils were not paraffined, showed the effect more strongly than any except the 40,000 Elliott. It was observed that the coil terminal connected to the positive pole of the battery in charging, was itself positive in discharging; that reversing the battery reversed the discharge deflection; that the deflection was not momentary, as with condensers, but that it indicated a steady current, diminishing slowly, but not ceasing in some instances after eight or ten hours; that when the coil was charged by battery for several minutes, and then the current reversed and allowed to flow a few minutes longer, the discharge current was at first due to the last charging current, but after a time it ceased, and was followed by another

discharge current due to the first charging. An experimental coil was then made up of 1,800 ohms of wire having unparaffined cotton insulation. It was wound on a warm rainy day, and tested immediately, showing the strongest polarization found, driving the spot of light violently off the scale. The coil was then baked in a hot-air oven at 150° C. for an hour, and tested again when cool. No trace of polarization could then be found, though the charging current was increased. The previous observations of course indicated electrolytic polarization as the disturbing cause; and the last showed, that, in the case of that coil, it was electrolysis of water absorbed from the air by the cotton insulation. The experimental coil was then heated, and soaked well with pure paraffine, and drained while hot until it seemed to be as nearly as possible in the same condition as the 40,000 Elliott coil, and tested when cool. No trace of polarization was shown. It was then put aside in the instrument case to see whether it could still absorb water enough to polarize. Ten days later, just after the Buffalo meeting, the coil was tested again and polarized strongly. On heating it again, the polarization entirely disappeared. A drop of hydrant water placed on the coil caused polarization to re-appear in five seconds, and in five minutes the effect was so strong as to drive the needle to its stops.

The degree of error in measurement resulting from polarization was not examined, but Professor Mendenhall's statements show that it may be a considerable quantity.

It is obvious that unparaffined coils are, on this account, unsuited to the best work; also that coils well paraffined (as in the B.A. unit coil) or coils freshly baked and paraffined are free from such error.

The paraffining of ordinary coils, even when as thoroughly done as by the Elliotts, is not a permanent protection, probably because of cracking of the mass of paraffine, allowing vapor to reach the wire and insulation. A test will quickly determine the condition of any particular coil. A box might be made proof against polarization by filling entirely the space about the freshly baked coils with pure paraffine, just warm enough to flow freely. Temperature difficulties could be in part overcome by thermo-junctions, as in standards. Another and on some accounts better plan would be to mount the coils in an impervious box with liquid-tight joints, and filling the interior with a petroleum oil, which may readily be found in market, of such quality as to exhibit no polarization. With such a box, there need be no uncertainty as to the temperature of the coils.

BENJ. F. THOMAS.

Columbus, O., Dec. 27.

## Atmospheric lines in the solar spectrum.

The ingenious device recently published by Mr. Conner, for detecting the lines in the solar spectrum due to the earth's atmosphere, recalls a similar plan proposed by the writer some years ago. In a letter dated Feb. 21, 1883, I wrote to Professor Rowland, "I hope that you will try the experiment of which I spoke to you last summer, — forming two images of the sun, and photographing the spectra of the opposite limbs. A glance would serve to distinguish the solar from the telluric lines." An accompanying sketch showed that a double-image prism was to be placed between the slit and a lens forming an image of the sun upon it. This prism was to be moved until the two images were in contact. The east and west limbs were thus brought together, and the slit was placed at right angles to their line of junction. In the photograph, telluric lines should cross the spectrum undeviated, while solar lines would be bent in opposite directions where they crossed the line of separation of the two spectra. The advantages of this method over that of Mr. Conner are, first, its simplicity, as it is easily tried by any one who has a spectroscope giving a sufficient diffusion; secondly, the solar lines, instead of becoming hazy, continue well defined. For these reasons I call attention to the matter, and not to detract from the credit due to the eminent French physicist, who has preceded me both in trying and publishing a solution of this very important problem.

EDWARD C. PICKERING.

Harvard coll. observ., Jan. 1, 1887.

## A brilliant meteor.

On Jan. 3, 1887, at 5.15 P.M., I observed a meteor of unusual brilliancy. It started, as nearly as I could make out, from the constellation Ursa Minor, possibly a little higher up, moving with a rapid rush and brilliant light in an easterly direction. As it neared the horizon, its speed apparently diminished, until it disappeared behind some trees. It was visible fully thirty seconds, and, during the last part of its flight, appeared to float slowly downwards. A trail of considerable length was drawn behind, giving it the appearance of a large rocket. Its flight was unattended by any sound.

R. W. WOOD, Jr.

Jamaica Plain, Mass.

## What was the rose of Sharon?

I notice in your issue of Dec. 31 an article on the rose of Sharon. Without desiring to enter into the discussion of this subject, I wish to refer those interested to a few words upon this subject by an eminent investigator. Speaking of that part of the pleistocene plain near Jaffa, bordering the Mediterranean Sea, Sir J. W. Dawson, in his recent work on 'Egypt and Syria,' says, "In February we found it gay with the beautiful crimson anemone (A. coronaria), which we were quite willing to accept as the 'rose of Sharon,' while a little yellowish-white iris, of more modest appearance, growing along with it, represented the 'lily-of-the-valley' of Solomon's song." From this would it not be reasonable to infer that this anemone is quite generally recognized as the 'rose of Sharon'?

AMOS W. BUTLER.

Brookville, Ind., Jan. 3, 1887.

## Electrical phenomena on a mountain.

In confirmation of the observations of M. F. (*Science*, viii. p. 564) in relation to electrical phenomena on Lone Mountain, near Bozeman, I beg leave to call attention to the fact that more than twelve years ago Mr. Franklin Rhoda, assistant topographer, in his 'Report on the topography of the San Juan country' (*vide* F. V. Hayden's *Report of U.S. geological and geographical survey of the territories for the year* 1874, pp. 456–458, also p. 461), gives a detailed and graphic account of similar electrical manifestations experienced by Mr. A. D. Wilson and

himself at station No. 12, on one of the peaks of the San Juan Mountains, in August, 1874, at an altitude of 13,967 feet above the level of the sea.

An interesting and significant circumstance recorded by Mr. Rhoda was the fact that there was a sudden and instantaneous cessation of the distressing electrical manifestations whenever a stroke of lightning took place, to be speedily renewed by the returning tension of the electricity. He says, "The sharp points of the hundred stones about us each emitted a continuous sound, while the instrument outsang every thing else, and, even at this high elevation, could be heard distinctly at the distance of fifty yards. The points of the angular stones being of different degrees of sharpness, each produced a sound peculiar to itself. The general effect of all was as if a heavy breeze were blowing across the mountain. The air was quite still, so that the wind could have played no part in this strange natural concert, nor was the intervention of a mythological Orpheus necessary to give to these trachytic stones a voice."

JOHN LE CONTE.

Berkeley, Cal., Dec. 25.

## Stereoscopic vision.

In reply to the inquiry of Mr. W. H. Pratt in the last issue of *Science*, it is necessary only to consider the various elements which are combined in the formation of a visual judgment. If an observer, who possesses but a single eye, looks out upon a landscape, the relative distance of the different objects viewed may be roughly estimated in terms of some standard arbitrarily chosen, so long as they are not precisely aligned with his eye. The judgment is less accurate as the angular separation of the objects becomes less, and as there are fewer of them at moderate distances for comparison with the rest. Always, and usually unconsciously, he employs one or more of the following elements in judging the distance and form of each object regarded: —

I. Near objects subtend larger visual angles than remote objects of equal size.

II. Near objects are seen more distinctly than those that are remote. The illusion of distance may hence be produced by decreasing the brightness of the object viewed, by changing the nature of the medium, or by increasing the contrast between light and shade.

III. Near objects that are almost aligned with those which are remote, often partly cover them. Covering objects are judged nearer than those covered.

IV. Familiarity with the dimensions of known objects when near enables us to compare them when remote, and thereby judge their relative distance.

V. By moving from one stand-point to another, and comparing the new view with what is retained in memory of the previous one, parallax of motion thus contributes to the formation of a judgment of both distance and form.

All of these elements may be imitated in pictures, except the last. In the examination of ordinary stereographs they are combined with the important element of binocular perspective, and to such an extent that it is impossible to know just how much we are indebted to binocular perspective for the illusion of apparent relief. Skeleton diagrams, properly constructed, are hence the only means of studying stereoscopic vision, if this term be taken as a synonyme of binocular vision. If Mr. Pratt will try his method with an outline drawing, it will fail.

In regarding an ordinary painting, binocular vision is often a hinderance, rather than an aid, in appreciating perspective. It is at least important to cut off from view the objects surrounding the picture, which we involuntarily take into comparison with it. In the application of geometry to perspective, a single point of view (station-point) is always assumed, and in examining the result the observer should place a single eye as nearly as possible at the same station-point to attain the best perspective illusion. The other eye must be closed, if he wishes to exclude the interfering element of binocular vision which will at once be unconsciously applied to the card or canvas on which the picture has been made.

It is by the observance of these precautions that Mr. Pratt has been able to appreciate perspective in the pictures examined, but true stereoscopic vision was excluded instead of being attained by what he may have supposed to be a new method.

W. LECONTE STEVENS.

Brooklyn, Jan. 1, 1887.

## Star rays.

Mr. Randolph will find the phenomenon of the long vertical rays or streamers proceeding from a strongly luminous point described and fully explained in my little volume entitled 'Sight,' pp. 87–89. They are produced, not by *reflection* from the eyelashes, as he supposes, but by *refraction* of light passing through the meniscus of moisture between the lid and the cornea, and are therefore more distinct when the lids are brought near together. I had investigated the phenomenon and ascertained its cause before I was aware of the very brief mention of it in Daguin's 'Traité de physique,' vol iv. p. 323.

The radiating points about a star are more difficult to explain. They are probably due to some peculiarity in the structure of the crystalline lens.

JOSEPH LECONTE.

Berkeley, Cal., Dec. 25.

## A German sentence.

In your current number you give an example of a German sentence. In *Teutonicity* it can hardly compete with the following extract from an advertisement of a well-known periodical: "Als eines der vorzüglichsten Weihnachtsgeschenke müssen die elegant gebundenen Quartalsbände der Deutschen Rundschau herausgegeben von Julius Rodenberg Preis pro Band in elegantem, rothem Originalleinwandband mit Schwarz und Golddruck 8 Mark bezeichnet werden." N.

Washington, Jan. 3, 1887.

## Pleuro-pneumonia.

It may not be worth while to call attention to two slight mistakes in the printing of my communication on p. 631 (viii. No. 204). The 'meplis' should be 'Mehlis,' the author of micrurus; and the 'U. S. fish commission' on the first line of second column should be 'U. S. entomological commission.'

C. V. RILEY.

Washington, D.C., Jan. 3, 1887.

## Calendar of Societies.

*Anthropological society, Washington.*

*Dec.* 21. — C. E. Dutton, Mr. Henry George's 'Progress and poverty.'

*Engineers' club, Philadelphia.*

*Dec.* 18. — Kenneth Allen, A table of thicknesses of plates for standpipes, with formulae, for the reference-book; L. M. Haupt, Results of some calculations upon the equilibrium and stability of his system of floating deflectors; A. H. Howland, Standpipes; J. H. Harden, Notes upon the Chester county, Penn., granite.

*Society of arts, Boston.*

*Dec.* 23. — E. C. Pickering, Stellar photography.

*Society of natural history, Boston.*

*Jan.* 5. — F. W. Putnam, Explorations in the Little Miami valley, Ohio.

*Indiana academy of science, Indianapolis.*

*Dec.* 29, 30. — D. S. Jordan, The dispersion of fresh-water fishes; J. N. Rose, The mildews of Indiana; C. R. Barns, The moss leaf; S. Coulter, The chlorophyl bands of Spirogyra; Lillie J. Martin, Outline of a course in science study based on evolution; Geo. H——, Additions to the flora of Jefferson county; J. M. Coulter, Origin of the Indiana flora; E. R. Quick, Our blind mice; A. W. Butler, Notes on the house-building habit of the muskrat; O. P. Hay, A curious habit of the red-headed woodpecker; A. W. Butler, Notes on Indiana ornithology; B. W. Evermann, Notes on birds observed in Carroll county, Ind.; O. P. Hay, The higher classification of the amphibia; Some reptiles and amphibians that appear to be rare in Indiana; Some reptiles and amphibians that are to be looked for in Indiana; Notes on the winter habits of Amblystoma tigrinum and A. microstoma; C. H. Eigenmann and Elizabeth G. Hughes, Review of Diplodon and Lagodon; C. H. Eigenmann and Jennie Horning, Review of American Chaetodontidae; O. P. Jenkins, The fishes of the Wabash and some of its tributaries; D. S. Jordan, The relation of latitude to the number of vertebrae in fishes; S. E. Meek, Elagatis pinnulatus at the eastern end of Long Island; H. L. Osborn, Osphradium in Crepidula; C. H. Bollman, Notes on the Acrididae of Bloomington, Ind., with descriptions of four new species; Jerome McNeill, A remarkable case of longevity in the longicorn beetle, Eburia quadrigeminata Say; F. M. Webster, Some biological studies of Lixus macer Say, and L. concavus Lee; J. McNeill, Descriptions of four new species of myriapods from the United States; C. H. Bollman, New North American myriapods, chiefly from Bloomington, Ind.; R. F. Hight, On the Thysanura; J. McNeill, The teaching of entomology in the high schools; J. L. Campbell, The geodetic survey in Indiana; T. C. Mendenhall, Recent progress in seismology; J. C. Branner, An Indiana earthquake; A. J. Phinney, Natural gas and petroleum; D. W. Dennis, The bearing of the Lebanon beds on evolution; J. T. Scovell, The geology of Vigo county, Ind.; A. J. Phinney, Zoantharia rugosa; V. C. Alderson, Town geology, what it is, and what it might be; J. H. Means and J. C. Branner, Preliminary location of a parting in the sub-carboniferous of Monroe county, Ind.. W. P. Shannon, The physical geography of Decatur county, Ind., during the Niagara period; J. T. Scovell, The Niagara River; C. R. Dryer, The surface geology of the Wabash-Erie divide; O. P. Hay, The manner of deposit of the glacial drift, and the formation of lakes; J. C. Branner, The limit of the drift in Kentucky and Indiana; The deep well at Bloomington, Ind.; Daniel Kirkwood, The zone of minor planets; H. W. Wiley, Causes of variation of sucrose in sorghum; P. H. Baker, The new alkaloid, cocaine; A. B. Woodford, The nation, the subject-matter of political science.

*Engineers' club, St. Louis.*

*Dec.* 21. — Announcement of the death of Col. C. Shaler Smith.

*Wisconsin academy of sciences, arts, and letters.*

*Dec.* 28–29. — R. D. Irving, The basal conglomerate of the Huronian; R. D. Salisbury, Constitution of the residuary clays; T. C. Chamberlin, Glacial phenomena about the head of Lake Michigan; I. M. Buell, Bowlder trains of Dodge, Dane, and Rock counties; F. B. Power, Disinfection; P. R. Hoy, Science and society; W. F. Allen, The genesis of the town; John Bascom, Limitations of political economy; J. J. Blaisdell, The methods of science.

### Publications received at Editor's Office, Dec. 20-25.

**Brinton**, D. G The conception of love in some American languages. Philadelphia, *McCalla & Stavely, pr.*, 1886. 18 p. 8°.

**Brownell**, H. Handbook for school trustees in the state of New York. Syracuse, *C. W. Bardeen*, 1886. 4+64 p. 16°.

**Comfort**, G. F. Modern languages in education. Syracuse, N.Y., *C. W. Bardeen*, 1886. 40 p. 16°.

**Education**, circulars of information of the bureau of. No. 1, 1886: The study of music in public schools. Washington, *Government*, 1886. 78 p. 8°.

**Heberden**, C. B. Euripides Medea. Parts i., ii. (Clarendon pr. ser.) Oxford, *Clarendon pr.*, 1886. 80+59 p. 16°. (New York, Macmillan, 50 cents.)

**Illinois** state board of health, report of proceedings of the. Springfield, *State*, 1886, 16 p. 12°.

**Sloman**, A. P. Terenti Adelphi. (Clarendon pr. ser.) Oxford, *Clarendon pr.*, 1886. 32+128 p. 16°. (New York, Macmillan, 75 cents.)

**Sweet**, H. Second middle English primer. Extracts from Chaucer. (Clarendon pr. ser.) Oxford, *Clarendon pr.*, 1886. 6+112 p. 16°. (New York, Macmillan, 50 cents.)

**Williams**, G. A. Topics and references in American history, with numerous search questions. Syracuse, N.Y., *C. W. Bardeen*, 1886. 50 p. 16°.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 7, 1887.

## *TAXATION OF PERSONAL PROPERTY IN FRANCE, GERMANY, AND THE UNITED STATES.*

WHEN Lord Rosebery was in Mr. Gladstone's cabinet as secretary for foreign affairs, he instituted some investigations through his diplomatic and consular officers that resemble closely those carried on by our consuls during the past decade in accordance with the system inaugurated by Secretary Evarts. One of Lord Rosebery's investigations had reference to the system under which personal property is brought into contribution for local or national purposes, and was undertaken by the British ministers at Paris, Berlin, and Washington. The returns have recently been embodied in a parliamentary paper, and present many points of interest. In France there are four heads of direct taxes, — the real-property tax (*contribution foncière*), the door-and-window tax, the personal-property tax (*contribution personnelle et mobilière*), and the tax on professions. The total amounts to be obtained from the first three taxes are first fixed by the budget, and are then divided and subdivided between the departments, *arrondissements*, and communes, until finally the share of each tax-payer is decided on. The *contribution personnelle et mobilière* is of two kinds. The first is a poll-tax of what is considered equivalent to three days of labor, and is payable by every Frenchman in France, and every foreigner of either sex who is not reputed indigent, and who is in possession of his or her 'rights.' The minimum of this tax is 1 franc 50 centimes, and the maximum 4 francs 50 centimes. The second form of personal tax is laid on all those liable to the poll-tax, and is proportioned to the letting price of the house or apartment each may inhabit. The assessors are the mayor of the commune and his adjoint or adjoints, and five citizens, termed *répartiteurs*, named by the head of the *arrondissement*, and changed annually. An elaborate system of councils provides for the assessment, collection, and payment of these taxes. Besides these main state taxes, there are so many *centimes additionnels*. These are of three kinds, — *généraux*, when for the exigencies of the state; *départementaux*, when for the departmental administration; *communaux*, when for the communal administration. A special category of *centimes additionnels* is also provided, the returns from which are granted to the ministry of agriculture or finance for special emergencies, such as the abatement or return of taxation to persons or districts which have suffered from floods, fire, hail, etc.

The tax on professions or trades (*patentes*) is also a personal tax, but its amount cannot, like the other three, be fixed beforehand. There is an official scale according to which each industry or profession is taxed; and the administrator of direct taxes determines the schedule into which each tax-payer shall be placed, and settles the *droit fixe* and the *droit proportionnel*. The *droit fixe* is based on the population and the nature of the trade or profession. The *droit proportionnel* is fixed according to the annual rental of the buildings or premises used for the exercise of the trade, industry, or profession. This *contribution des patentes* is due by every Frenchman or foreigner who exercises a trade, industry, or profession not included in the exceptions made by law. Mr. Edgerton, who has prepared the paper on personal taxation in France, remarks that the general tendency of late changes in the scale of this tax has been to abate the amounts paid by the smaller industries, and to increase those paid by the larger ones. For example: in 1880 the fixed *patentes* on bankers was increased from 1,000 to 2,000 francs.

The return for Germany in answer to Lord Rosebery's circular applies to Prussia only, as no direct taxes are levied for the account of the imperial government. But Prussia serves as a type of all the other German states, since their system and method of assessment are modelled on hers.

In Prussia all communes not having sufficient independent revenue to cover their local requirements may raise such necessary revenues, either by surtaxes (*zuschläge*) based on the rates of certain specified state direct taxes, or by special sanction from the state to impose special taxes, direct or indirect. The former alternative is the one usually chosen by such communes as have not an independent revenue from real property. The wealthiest communes dispense with these surtaxes altogether, while in the poorer communes the surtax is as high as 300 or 400 per cent of the state tax. The state taxes, which serve as the basis of computation for these surtaxes, are: — (*a*) Personal: I. Class tax on personal net annual incomes under 3,000 marks; II. Classified income

tax on annual net incomes above 3,000 marks; III. Trading tax. (*b*) On real property: IV. Ground tax; V. House tax.

Under I. were put, in twelve classes, the incomes above 420 and under 3,000 marks; and the annual tax is from 3 to 72 marks, incomes under 420 marks being exempt.

By a law passed in 1883, all incomes under 900 marks were exempted, and the remaining classes relieved from one-fourth of their tax; the instalments due in July, August, and September of each year being remitted.

Under II. are put the incomes over 3,000 marks; and they fall into forty classes, the tax ranging from 90 to 21,600 marks, the latter on an income from 720,000 to 780,000 marks. The pay of persons in the standing army is exempt from state taxation, and has only this year been made liable to local taxation. In assessing the communal surtaxes, only half the salary of government officials is taken into account. An annual net income is construed to be the net income derived from all descriptions of property and occupations after deducting interest paid on proved debts, amounts paid in other taxes, and costs of production. Deductions are also allowed in special cases where the tax-payer has a large family to support. The assessment of this class tax is intrusted to a board composed of the president of the commune and of members elected by the communal representative body, all classes of tax-payers being represented as far as possible. Each tax-payer is duly notified of the class in which he is placed, and opportunity is offered him for protest or application for deduction.

The system of assessing III., the trade tax, is quite complicated. Persons liable to this tax are distributed into classes, ranging from large trades down to hackmen. The individual assessment is thus determined: each class, except the highest, is subdivided into four sections, and a medium rate is fixed for each section in each class. This medium rate, multiplied by the number of persons liable for taxation in the first three sections of each class in the case of towns, and in the fourth section in the case of a *Kreis* or circumscription, represents the total annual amount of the tax for which the town or *Kreis* is liable, and which it has to collect for the state. If the medium rate falls too heavily on any members of a class, they are assessed less, and the rate is raised for those members of the same class who are better able to pay. Steamers pay an annual tax of 0.75 of a mark for every horse-power; and carriers by land, with two horses and upwards, pay an annual tax of 3 marks for each horse.

The report on the United States is prepared by Mr. Helyar, second secretary of legation at Washington, and is based on the works of Burroughs and Cooley, and on some details gathered by Mr. E. J. Reinck of the U. S. treasury.

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## *A HAIRY HUMAN FAMILY.*

THE superabundance of hair in certain members of the human family is one of the important problems of anthropology. Dr. Ecker named this phenomenon 'hypertrichosis' ('On the pilous system and its anomalies,' analyzed in *Revue d'anthropologie*, 1880, p. 170). In Ecker's third class, or 'dog-men,' are included those subjects in which the hypertrichosis is general. In 1879 two Russians, father and son, were exhibited in Paris, who were good examples of this anomaly. The case of Barbara Ursler, reported in 1639–56, is reviewed by Dr. Ecker, with an illustration, in *Archiv für anthropologie*, xi. 1879, p. 176 (see also *Globus*, xxxiii. 1878, Nos. 12 and 14; and Stricker, 'Ueber die sogenannten Haavmenschen, Frankfurt-a.-M.,' 1877, p. 97; Bernhard Ornstein, in *Archiv für anthropologie*, xvi. pp. 505–510; Dr. O. Fraas, *Archiv*, xiv. 1883, pp. 339–342; Mme. Clemence Royer, 'Sur le système pileux,' *Revue d'anthropologie*, 1880, pp. 13–26).

Adrien Teftichew, of the government of Kostroma, Russia, mentioned above, was, at the time of his exhibition in Paris, fifty-five years old. It was from his appearance that this type received the name of 'dog-men.' His forehead, cheeks, eyelids, ears, and nose were covered with long, smooth hair. The neck, body, and extremities were covered with hair, but not so long as that upon the face. The son Theodore did not differ materially in this respect from his father.

The Birman family, as described by Ecker, consisted of Schwé-Maong, thirty years old, his daughter Maphoon and her two sons, — three generations presenting this anomaly. Moreover, the lower jaw of Schwé-Maong had only four incisors and the left canine; the upper jaw, only four teeth; the molars are entirely wanting, their place being filled by fleshy gutters on the gums. Even the alveolar processes are supposed to be absent.

Schwé-Maong affirms that he never lost any teeth, and that the eruption of his permanent teeth did not take place until he was twenty years old. Maphoon also lacks canines and molars, whose places are supplied by the fleshy gutters with which she does her masticating.

Dr. Ecker further describes the famous Mexican danseuse, Julie Pastrana, and a child named Possassi, of Hufeland, described by Dr. Beverne in 1802.

It is well known that at seven months the human foetus is entirely covered with hair. These hairs traverse the skin obliquely, and continue to increase slowly until they attain from a quarter to half an inch in length, when they are replaced by the small persistent hairs. The infant comes into the world covered with embryonal hair. The dog-men are covered with a woolly or silky hair, presenting embryonal characters. Both Ecker and his reviewer, Dr. Vars, agree that general hypertrichosis is simply an arrest of development; that is to say, the down, instead of being replaced by hair, persists and continues to develop.

I had not heard of the transfer of the Birman family to England until I read the newspaper report recently. There is no reason to discredit the account, proper allowance being made for enthusiastic hyperbole. O. T. MASON.

## CONTAGIOUS DISEASES.

IN a paper recently read before the Philadelphia county medical society, Dr. Arthur V. Meigs takes the ground that scarlet-fever is very much less contagious than is commonly supposed; much less, in fact, than measles and whooping-cough; and in proof of his opinion, he cites the fact, that, while it is the rule for measles and whooping-cough to affect all the children in a household, scarlet-fever usually limits its attack to one or two, even though there may be others who have never had the disease, and are therefore presumably susceptible. There is one point which the author of the paper does not, it seems to us, lay sufficient stress upon; and that is, that, while parents dread scarlet-fever, they have but little fear of measles or whooping-cough, and, being influenced by that popular impression that all children must at some time of their lives have these latter diseases, they take no pains to isolate the sick from the well, as they do if the disease be scarlet-fever. The writer could give repeated instances where the most rigid isolation was practised in cases of measles, in which but one member of a family was attacked, though there were a number of others who were presumably susceptible. Until, therefore, the same scrupulous care is taken to separate the affected child from the unaffected in measles as is done in scarlet-fever, we shall hesitate to accept the conclusion that scarlet-fever is much less contagious than measles. This will probably never be done until parents are taught that measles is not a trivial disease, but is, in fact, many times a most serious one. In England the number of deaths in five years from measles was 42,139; in Brooklyn in ten years 1,012 children died from this cause; and in New York during the week ending Dec. 4, 42 deaths from it are recorded. This takes no account of the countless number that are left with impaired constitutions and lung diseases, and who, within a very short time after this attack of measles, appear in the mortality statistics as victims to bronchitis or pneumonia. And the same may be said of whooping-cough, — a disease which, in the period 1875–79, caused in England alone 66,730 deaths.

## SYNECHDOCHICAL MAGIC.

ALL students of anthropology are familiar with the belief among lower peoples that what is done to a part of a person or to his property is done to him. These people all dread to have the smallest part of their bodies or their intimate possessions go from them. It has always seemed to me to need further explanation, a more simple and commonplace solution.

This is given in Mr. A. W. Howitt's paper in the August number of the *Journal of the Anthropological institute*. I quote his language: —

"Connected with the throwing of magical substances in an invisible form is the belief that they can be caused to enter the body of a victim by burying them in his footsteps, or even in the mark made in the ground by his reclining body. Sharp fragments of quartz, glass, bone, charcoal, are thus used, and rheumatic affections are frequently attributed to them.

"Another form of this belief is seen in the practice of putting the jagged cone of the Casuarina quadrivalvis into a man's fire, so that the smoke may blow into his eyes and cause him to become blind. The idea seems to be that the *eidolon* of the cone will produce acute ophthalmia.

"A piece of hair, some of his faeces, a bone picked by him and dropped, a shred of his opossum rug, will suffice. Even his saliva may be picked up and used for his destruction."

The explanation of all this, which I have long sought, is given in the very words of one of Mr. Howitt's informers, who said, "You see, when a blackfellow doctor gets hold of something belonging to a man and roasts it with things, and sings over it, *the fire catches hold of the smell of the man* [italics mine], and that settles the poor fellow." In other words, the smallest part of a man, or of any thing he has touched, will suffice to give the demon his scent.

Of course, customs survive millenniums after the cause of their origin is forgotten, and it is scarcely probable that those who carefully burn their waste hair and nails do so to avoid giving

the witches their scent or the means of indentifying them. The savage who refuses to allow his picture to be taken, and the felon who objects to having his 'mug' adorn the walls of Rogues's gallery, are not so far apart, if we can bring our minds to identify the devil of the former with the detective of the latter. O. T. MASON.

## PROFESSOR NEWBERRY ON EARTHQUAKES.

PROFESSOR NEWBERRY'S paper on earthquakes is, in the words of the author, "a brief review of what is known and believed in regard to the phenomena and causes of earthquakes by those whose opinions on this subject are most worthy of confidence." After defining the word 'earthquake,' he proceeds to give a summary of the facts upon which he bases his definition, carefully elaborating and illustrating the subject from the point of view of a cooling and contracting sphere, with a relatively thin crust, and fluid or viscous interior. The latter part of the essay is treated under the headings, 'Earthquakes and volcanoes as measures of the thickness of the earth's crust,' and 'Flexibility of the earth's crust.' Finally, 'Proximate causes of earthquakes' are briefly considered, and a short bibliography is appended.

The definition, which is taken as the text, and which is really an epitome of the whole argument, is as follows: "An earthquake is a movement caused by a shrinking from the loss of heat of the heated interior of the earth, and the crushing-together and displacement of the rigid exterior as it accommodates itself to the contracting nucleus." It is then stated that the facts upon which this statement is based are so numerous and significant that the conclusion 'is not only convincing, but inevitable.' Although this broad generalization is perhaps applicable in the case of most earthquakes, and the theory as to the structure of the earth which it involves is very generally accepted by geologists, yet, in view of the fact that many eminent scientific men are not prepared to subscribe to it at all, in either case it is to be regretted that the author has not adopted the comprehensive and more non-committal definition given by Mallet, and substantially repeated as follows by Powell (in *The forum* for December): "An earthquake is the passage of waves of elastic compression in the crust of the earth." The very fact that different theories are to be found, even in the very latest utterances of eminent authorities, would seem to make it desirable to acknowledge that the subject is not one that can be disposed of in such an *ex cathedra* statement, but rather one worthy of the most painstaking study, which, indeed, it is now receiving from the most advanced nations. The further statement that "earthquakes are neither novel nor mysterious, but are among the most common and simplest of terrestrial phenomena," is not likely to receive very wide acceptance in its entirety, and issue will certainly be taken with Professor Newberry as to there being any very great degree of unanimity in this opinion among "those whose opinions are most worthy of confidence." Similarly it must be said that far more confidence is placed by the author in the various methods of calculating the depth of origin by means of accurate observations as to time and angle of emergence than seems warranted. The problem is so complicated by the great heterogeneity of the superficial formation of the earth's crust, that the best observations we can make, give, at best, only roughly approximate results. Again, it is stated that the reported shortening of railroad-tracks in certain places near Charleston, "if verified and measured, would give a clew to the location and extent of the subterranean movements which produced the vibrations." Most authorities, however, will probably regard it, in the case of a shock disturbing so great an area, as an entirely secondary effect, along with the production of local sinks, geysers, and land-slides.

This well arranged and condensed *résumé* of the subject, from the stand-point of a geologist of Professor Newberry's reputation, cannot fail to be read with interest by the general reader as well as by the special student. The only criticism that can he made, other than favorable, seems to be that to the average reader it may leave the impression that the causes of all earthquakes, and even the nature of the earth's interior, are now so well understood as to leave very little room for difference of opinion among those best qualified to judge. EVERETT HAYDEN.

*Earthquakes.* By Prof. J. S. NEWBERRY. New York, *The author*, 1886. 8°.

## PHANTASMS OF THE LIVING.

THIS is a most extraordinary work, — fourteen hundred large and closely printed pages by men of the rarest intellectual qualifications, for the purpose of setting on its legs again a belief which the common consent of the 'enlightened' has long ago relegated to the rubbish-heap of old wives' tales. In any reputable department of science the qualities displayed in these volumes would be reckoned superlatively good. Untiring zeal in collecting facts, and patience in seeking to

*Phantasms of the living.* By EDMUND GURNEY, FREDERIC W. H. MYERS, and FRANK PODMORE. 2 vols. London, *Trübner*, 1886. 8°.

make them accurate; learning, of the solidest sort, in discussing them; in theorizing, subtlety and originality, and, above all, fairness, for the work absolutely reeks with candor, — this combination of characters is assuredly not found in *every* bit of so-called scientific research that is published in our day.

The book hardly admits of detailed criticism, so much depends on the minutiae of the special cases reported: so I will give a broad sketch of its contents. The title, 'Phantasms of the living,' expresses a theory on which the recorded facts are strong, but of which the latter are of course independent. The 'facts' are instances of what are commonly called 'apparitions.' Collected for the Society of psychical research, their sifting and cataloguing is a laborious piece of work which has a substantive value, whatever their definitive explanation may prove to be. Very roughly speaking, there are reported in the book about seven hundred cases of sensorial phantasms which seem vaguely or closely connected with some distant contemporaneous event. The event, in about one-half of the cases, was some one's death. In addition to these cases, Mr. Gurney has collected about six hundred of hallucinations seemingly irrelevant to any actual event, and thus has certainly a wider material to work upon than any one who has yet studied the subject of phantasms. Of course, the rationalistic way of interpreting the coincidence of so large a number with a death or other event, is to call it chance. Such a large number of 'veridical' phantasms occurring by chance would, however, imply an enormous total number of miscellaneous phantasms occurring all the while in the community. Mr. Gurney finds (to take the visual cases alone) that among 5,705 persons, interrogated at random, only 23 visual hallucinations had occurred in the last twelve years. And combining by the calculus of probabilities such data as the population drawn upon for the coincidence-cases, the adult population of the country, the number of deaths in the country within twelve years, etc., he comes to the conclusion that the odds against the chance occurrence of as many first-hand and well-attested veridical visual phantasms as his collection embraces, is as a trillion of trillions of trillions to 1. Of course, the data are extremely rough; and, in particular, the census of phantasms occurring at large in the community ought to be much wider than it is. But the veridical phantasms have, furthermore, many peculiarities. They are more apt to be visual than auditory. Casual hallucinations are oftener auditory. The person appearing is almost always recognized; not so in casual hallucinations. They tend to coincide with a particular form of outward event, viz., death. These and other features seem to make of them a natural group of phenomena.

The next best rationalistic explanation of them is that they are fictions, wilful or innocent; and that Messrs. Gurney, Myers, and Podmore are victims, partly of the tendency to hoax, but mainly of the false memories and mythopoietic instincts of mankind. These possibilities do not escape our authors, but receive ample consideration at their hands. Nothing, in fact, is more striking than the zeal with which they cross-examine the witnesses; nothing more admirable than the labor they spend in testing the accuracy of the stories, so far as can be done by ransacking old newspapers for obituaries and the like. If a story contains a fire burning in a grate — *presto* the Greenwich records are searched to see whether the thermometer warranted a fire on that day; if it contains a medical practitioner, the medical register is consulted to make sure *he* is correct; etc. But obviously a hoax might keep all such accessories true, and a story true as to the main point might have grown false as to dates and accessories. It therefore comes back essentially to the investigator's instinct, or *nose*, as one might call it, for good and bad evidence. A born dupe will go astray, with every precaution; a born judge will keep the path, with few. *Saturday reviewers* will dispose of the work in the simplest possible way by treating the authors as born dupes. 'Scientists' who prefer offhand methods will do the same. Other readers will be baffled, many convinced. The present writer finds that some of the cases accounted strong by the authors strike him in the reading as weak, while scruples shown by them in other cases seem to him fanciful. This is the pivot of the whole matter; for I suppose the improbability of the phantasms being veridical by chance, will, if the *stories* are true, be felt by every one. Meanwhile it must be remembered, that, so far as expertness in judging of truth comes from training, no reader can possibly be as expert as the authors. The way to become expert in a matter is to get lots of experience of that particular matter. Neither a specialist in nervous diseases, nor a criminal lawyer, will be expert in dealing with these stories until he has had Messrs. Gurney's, Myers's, and Podmore's special education. Then his pathology, or his familiarity with false evidence, may also serve him in good stead. But in him, or in them, 'gumption' will, after all, be the basis of superiority. How much of it the authors have, the future alone can decide.

One argument against the value of the evidence they rely on is drawn from the history of witchcraft. Nowhere, it is said (as by Mr. Lecky in his

'Rationalism'), is better-attested evidence for facts; yet the evidence is now utterly discredited, and the facts, then apparently so plenty, occur no more. Mr. Gurney considers this objection, and comes to an extremely interesting result. After "careful search through about 260 books on the subject (including the principal ones of the sixteenth, seventeenth, and eighteenth centuries) and a large number of contemporary records of trials," he affirms that the only facts of witchcraft for which there is any good evidence whatever are those neuropathic phenomena (trance, anaesthesia, hysteria, 'suggestion,' etc.) which, so far from being now discredited, are more than ever ascertained; while the marvels like conveyance through the air, transformation into animals, etc., do not rest on *a single* first-hand statement made by a person not 'possessed' or under torture.

The authors' theory of veridical phantasms is that they are caused by thought-transferrence. The ghost theory and the 'astral-form' theory are criticised as unsatisfactory (ghosts of clothes, phantasms not seen by all present, etc.). Thought-transferrence has been once for all established as a *vera causa*. Why not assume that even the impressions announcing death were made during the last moments of the dying person's life?

Where the apparition is to several witnesses, this explanation has to be much strained; and, in spite of Messrs. Myers's and Gurney's ingenuity, I can hardly feel as if they had made out a very plausible case. But any theory helps the analysis of facts; and I do not understand that Messrs. Gurney and Myers hold their telepathic explanation to have at present much more than this provisional sort of importance.

I have given my impression of the ability of the work. My impression of its success is this: the authors have placed a matter which, previous to them, had been handled so locsely as not to compel the attention of scientific minds, in a position which makes inattention impossible. They have established a presumption, to say the least, which it will need further statistical research either to undo or to confirm. They have at the same time made further statistical research easy; for their volumes will certainly stimulate the immediate registration and publication, on a large scale, of cases of hallucinations (both veridical and casual) which but for them would have been kept private. The next twenty-five years will then probably decide the question. Either a flood of confirmatory phenomena, caught in the act, will pour in, in consequence of their work; or it will *not* pour in — and then we shall legitimately enough explain the stories here preserved as mixtures of odd coincidence with fiction. In the one case Messrs. Gurney and Myers will have made an epoch in science, and will take rank among the immortals as the first effective prophets of a doctrine whose ineffectual prophets have been many. In the other case they will have made as great a wreck and misuse of noble faculties as the sun is often called to look down upon. The prudent bystander will be in no haste to prophesy; or, if he prophesy, he will hedge. I may be lacking in prudence; but I feel that I ought to describe the total effect left at present by the book on my mind. It is a strong suspicion that its authors will prove to be on the winning side. It will surprise me after this if neither 'telepathy' nor 'veridical hallucinations' are among the beliefs which the future tends to confirm.

William James.

## *MURRAY'S HANDBOOK OF PSYCHOLOGY.*

Dr. Murray has written an excellent elementary text-book for students of psychology. In the present state of that science, it is difficult to present its doctrines in a form suitable for didactic purposes. It is often necessary for the author to leave untouched certain important questions, the settlement of which is only possible by a controversial excursion into the department of metaphysics.

Dr. Murray's book is not a treatise on physiological psychology, although the conclusions of physiologists seem to be familiar to him. He has occupied himself chiefly with what is called 'subjective psychology,'— a field which must be traversed before one can enter upon the more positive science of the relation of psychical to nervous states. He treats of psychology and its method, gives a full and satisfactory account of sensation, analyzing the knowledge given by the various senses, and noticing the subject of general or organic sensations. This is followed by an account of association and its laws, and a short chapter on comparison. These subjects constitute what he describes as 'general psychology.'

'Special psychology' has to do with 'cognitions, feelings, and volitions,'— a threefold division, corresponding to the classical partition of 'intellect, feeling, and will.' Under the head of 'cognitions' we find an account of perceptions, generalization, reasoning, idealization, illusory cognitions, and a chapter on the general nature of knowledge, which discusses 'self-consciousness, time, space, substance, and cause' from the psychological rather than the metaphysical point of view. After an introduction treating of the nature of pleasure and pain and the expression

*A handbook of psychology.* By J. Clark Murray. London, *Gardner*, 1885.

and classification of the feelings, are chapters on the feelings of sense, feelings originating in association, feelings for self and for others, feelings originating in comparison, intellectual feelings, and feelings of action. Four chapters are devoted to volition, the last treating briefly of the freedom of the will.

As we said above, the book is an excellent one, and few serious sins of commission can be charged against it. We question somewhat the advisability of the abrupt divorce of perception and sensation as kinds of mental conditions. Mr. Sully, in his 'Outlines of psychology,' agrees with the author in his separation of these states or actions. It seems to us that a sensation is nothing more than a nervous stimulus unless it is perceived. Perception is the perception of a sensation, and nothing more. When we pass beyond the perception of sensations to a knowledge, say, of objects, we may explain that knowledge either by the association of the perceptions, or by the union of the perceptions in the act of conception. For this reason we believe that those who, with Sir William Hamilton, use the term 'sense-perception,' use an awkward term, but one which is scientifically accurate.

The author's treatment of the process of representation is one of the most unsatisfactory parts of the book. His account of association is not sufficient to give information about all that we call popularly 'memory.' We also fail to find any chapters on reflex action or on the highly important subject of unconscious mental modifications. On the other hand, Dr. Murray's simple and interesting account of illusory cognitions deserves high commendation, and his classification of the feelings seems to us to be both natural and scientific.

The author (p. 23, *et seq.*) appears to view with but little favor the results of investigation in the department of psychophysics. We have no space to discuss the question how far his caution or scepticism is justified. On both sides of the Atlantic this branch of psychology is enjoying a very extraordinary share of attention, and suggestive and interesting results have been reached. We are inclined to regard these investigations as of less importance than those engaged in them are disposed to attach to them, and we confess that we await with some expectancy results commensurate with the amount of labor expended in gathering the statistics which form so prominent a part of the periodical literature on philosophy.

Dr. Murray's closing chapter on the freedom of volition, we regard as perhaps the least scientific part of his book. His doctrine is suggested in the sentence, "The very nature of volition, therefore, would be contradicted by a description of it in terms which brought it under the category of causality" (p. 417).

The book, however, is admirably adapted for teaching the elements of psychology to classes in schools and colleges.

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## *TWO VALUABLE PRIMERS OF POLITICS.*

IT has been said that greater ability is needed to develop and elucidate fundamental principles than to deduce from them an elaborate set of conclusions. This is doubtless true; and for that reason most primers, whether of literature, history, science, or politics, are failures, in that they are the work of well-meaning but insufficiently and narrowly informed students. That leading specialists can use their talents to good purpose in writing primers, and thus bring their influence directly to bear on the generation in process of education, has been amply demonstrated by Professors Huxley, Roscoe, Balfour Stewart, Geikie, Michael Foster, Jevons, and others. The two little books to which we have reference in the heading of this notice rank, with the works of the authors just mentioned, as primers that are worth something. They have something in common, in that they are written primarily for English readers by an English woman and an English man respectively. There the resemblance ceases. Miss Buckland's primer[1] is a summary of existing English institutions, and we are free to say that we have never seen them more clearly, more concisely, and more accurately pictured. Miss Buckland draws to a large extent from the books in the 'English citizen' series on particular institutions and phases of English politics, but the completeness and articulation of this little book are peculiarly her own. She treats of the constitution in general, of the sovereign, parliament, the house of lords, the house of commons, the privy council, the national budget, the English church, education in England, local government, and so on. The careful reader will obtain from the book a very thorough knowledge of the workings of English governmental institutions; and it is just such a book as a teacher should use for a few weeks with a class that has completed the study of English history, in order to enable the pupils to follow and discuss intelligently current English politics. We do not recall an inexact or wrong statement in the book, considered simply as an exposition. On p. 34 is an obvious misprint, £71,000 being given as the amount of the annual allowance to the Queen's family. The correct sum is £171,000, and it is so stated by Miss Buckland on p. 9.

[1] *Our national institutions: a short sketch for schools.* By ANNA BUCKLAND. London, *Macmillan*, 1886. 16°.

As Miss Buckland's primer is one of political exposition, so Mr. Raleigh's[1] is one of philosophical exposition, and it rises to a very high plane indeed. For obvious reasons the author's illustrations are drawn principally from English history and English institutions; but as society and civilization are not national, but international, Mr. Raleigh's able volume should attract much attention and find numerous readers in this country. In his preface the author states that most controversies would end before they begin if the disputants would only define the terms that they use. The pages that follow are an attempt to define and make explicit the terms used in political argument. As the author himself allows, his book will stimulate rather than satisfy inquiry; and for just that reason it is capable of becoming, in the hands of a competent teacher of civics or politics, an invaluable text-book. It is eminently impartial, and for that reason might in some parts mystify rather than satisfy the beginner; but, properly interpreted, it can be made of the greatest service. The author begins by summarizing (the whole book only contains 163 small pages) the principles which lie at the basis of society and civilization; then he examines modern society and the modern state, and passes to elections, party government, economic terms and principles, the functions of the state, and propositions looking to reform. Lack of space forbids our quoting as much as we should wish from Mr. Raleigh's compact volume, but to a few salient points we must call particular attention. He enforces, from many points of view, the position that no abstract theory of government, nor any radical law, can give the prosperity and satisfaction demanded by certain theorists who call for revolution and reform. "The cardinal error of revolutionary politicians is this, that they assume the possibility of breaking away from custom and tradition. They look on institutions as if they were purely artificial, and therefore alterable at pleasure. In point of fact, institutions are rooted in the natures of men who are accustomed to them. If all our laws were destroyed in a day, our habits and ways of thinking would remain, and out of these a new set of laws, not very unlike the old, would soon be developed. If we desire great changes, we must not put our trust in revolution: we must work steadily at those reforms which seem most likely to improve our habits and ways of thinking" (p. 127). And in connection with this subject, reform, there is this timely warning given: "When social reformers put forward schemes by which the strain of competition would be lessened, we must examine their proposals carefully, to find out whether they do not involve an appeal to the selfishness of the weak, which is just as dangerous in its way as the selfishness of the strong" (p. 97). Mr. Raleigh's remarks about speculation (p. 99), the effect of state help (p. 130), and his summary of how far state interference can safely go (pp. 150 and 157), are as scientific in form as they are satisfactory in contents. We most unreservedly commend the book as a clear, strong, and healthy primer of politics, and heartily wish that it could be studied and appreciated in every high school and by every citizen of the United States.

[1] *Elementary politics.* By THOMAS RALEIGH. London, *Oxford univ. pr.*, 1886. 16°.

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A SANITARY convention under the auspices of the Michigan state board of health was held at Big Rapids, Nov. 18 and 19, 1886. Dr. Stoddard read a paper on the injuries of every-day drug-taking.. It partly came from mothers dosing babies with soothing-sirup, paregoric, worm-lozenges, etc. The remedy was to educate the people in the injurious effects of drugs. Dr. Inglis of Detroit closed his remarks on alcohol as a medicine by saying that he should like to produce the continually accumulating evidence of the positive harm caused by such indiscriminate use of all kinds of alcoholic drinks, bitters, and tonics, and that physicians should let alcoholic liquor be the last, and not the first, remedy in the treatment of disease. Professor Ferris of the Industrial school read a paper on hygiene of schools, dwelling upon the lack of ventilation in the schools of Big Rapids, in several the air-space for each pupil not exceeding two hundred cubic feet. Papers were read on Pasteur and preventive medicine, public-health laws, and the prevention of communicable diseases.

— Intubation of the larynx, which has been introduced recently as a substitute for tracheotomy in cases of diphtheria and croup, is coming into general favor with medical practitioners. The credit of its introduction is due to Dr. O'Dwyer, a New York physician. Already one hundred and sixty-five cases have been reported in which it has been practised, with twenty-eight and one-half per cent of recoveries. The introduction of the tube into the larynx is a very simple operation, and requires no anaesthetic nor trained assistants. Inasmuch as no cutting operation is required, as in tracheotomy, there is no difficulty in persuading parents to consent to the intubation of their children, when the more formidable operation of tracheotomy would not be permitted. This percentage of recoveries will doubtless be much increased as physicians become more accustomed to the method.

# SCIENCE.

FRIDAY, JANUARY 14, 1887.

## COMMENT AND CRITICISM.

THE DANGER of long-range weather-prediction, even of the cautious kind lately indulged in by Dr. Hinrichs, is forcibly illustrated in the statements given in the advance proof of the Iowa bulletin for December. The month is described as very cold, fair, and dry, the mean temperature of the air being more than seven degrees below the normal. Only once in the past sixteen years has Iowa had a colder December (1876). This is not a satisfactory verification of the statement made a month ago: "The probability is very high that the winter now begun will be a mild one in Iowa and the north-west." Apparently as a comment on this discordance, Dr. Hinrichs says, "January will, it seems, also run decidedly below normal. February may be markedly above normal, and contribute greatly to reduce the severity of the winter [a possibility very much to be desired]. During the forty years preceding 1883, there never have been more than two consecutive cold winters in Iowa; namely, those of 1856 and 1857. Beginning with 1883, we have now had four severe winters in unbroken succession, and these winters have not been followed by a month of severe weather this winter. This is entirely without precedent, and of very serious import to the people of Iowa." That seems to be the difficulty: the weather cares too little for precedent.

THE HOLIDAY EDITION of the *Age of steel* deserves attention because of the number and interest of the economic articles it contains. In fact, it seems more like an economic than a technical journal. It is somewhat of a novelty, too, to find that the economics are thoroughly practical, the theoretical and speculative element occupying a very subordinate place. M. Godin, the founder of the Familistere, tells again briefly the well-known story of that institution. At the end of his article, the philanthropist grows confidential, and points out the principal obstacle with which his foundation has to contend. That obstacle is, as might have been suspected, nothing less than human nature itself. And it has happened in this way. The association has made large profits, which have been published every year. A knowledge of the detailed operations of the concern is accessible to the public. Just here the difficulty presented itself.



In the language of M. Godin, "instead of studying them [the annual balance-sheet, and so forth] for the purpose of imitating us by organizing labor, this is the way the filibusters in industry have argued: they have said to themselves, 'The Association of the Familistere pays actually about 1,800,000 francs ($360,000) in wages. If we establish a similar industry, copy its products, and pay 50 per cent less to our operatives than the Society of the Familistere pays theirs, we shall realize profits amounting to nearly a million more than it; so that it cannot compete with us, except it lowers wages, — a thing it cannot do, since its operatives are associates in its industry: thus we can beat them in the market.' These arguments have been carried out in practice, so that the Association of the Familistere has to-day to compete with establishments that let down wages to their lowest point, and, by these means, practise a deplorable competition, which push the wage-workers to strike and misery." These 'wrongs of egoism,' as M. Godin calls them, are the very things that idealists and reformers of all ages have had to contend against; and the fact that they are certain to recur is the neglected factor in the calculations of so many of the social reformers of our own generation.

PROFIT-SHARING is also the subject of several articles in the same journal. Prof. J. B. Clark of Smith college, and Frank A. Flower, commissioner of labor for the state of Wisconsin, write favoring profit-sharing; but the testimony of two large concerns — the Crane Brothers manufacturing company of Chicago, and the H. O. Nelson manufacturing company of St. Louis — is of more importance and value than any hypothetical arguments can possibly be. Mr. Crane says that his company has tried with much success the plan of permitting the employees to buy stock in proportion to their yearly salary, but, as in many cases the workmen are not prepared to buy the amount

apportioned to them, the plan has been adopted of allotting the stock to them, they enjoying the benefits of it less interest. To this plan, as to any other scheme of profit-sharing, the objection is raised that in bad times it passes into loss-sharing, and this is not what the employees want or will submit to. In view of this, Mr. Crane believes that a surplus fund should be established, from which dividends are to be paid during years of depression, when there is no profit from which to pay them.

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Mr. Nelson bears similar testimony to the working of profit-sharing in his company. In March last, the company issued a circular establishing profit-sharing. After allowing seven per cent interest on actual capital invested, the remainder is to be divided equally upon the total amount of wages paid and capital employed. The employees will this year receive about two-fifths of the net profits. The books have not yet been closed for the year, nor the dividend declared, but there is ample evidence of the success of the experiment. At the conclusion of the firm's present fiscal year, the scheme is to be elaborated somewhat. Ten per cent of the profits is to be set aside as a provident fund for sick and disabled members and the families of deceased ones, ten per cent as a surplus fund to cover losing years, should such occur, and two per cent as a library fund, the company paying interest on any unused portions of such funds. The allotments are also to be so apportioned that a premium is offered for continuous service and the saving of dividends. Evidence such as this from the sphere of practical business should be of great help to economists in developing their theories.

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THE ITEMS APPROPRIATED by the house for the support of the U. S. coast survey during the next fiscal year are the same as those at first recommended by the house last year, and far under the estimates. If the senate should agree to the penurious policy of the house, a large reduction in the *personnel* of the service must ensue, and its utility would be sadly impaired. We cannot believe the senate will agree to the recommendations of the house in this important matter. The coast survey is doing good work, which should be encouraged by congress, and liberal appropriations should be made for its proper support.

## *IS BEER-DRINKING INJURIOUS?*

WE have before us a direct and unqualified challenge to the prohibitionists in the form of a pamphlet on 'The effects of beer upon those who make and drink it,' by G. Thomann (New York, *U. S. brewers' assoc.*, 1886). The writer boldly presents the following propositions. 1. Brewers drink more beer, and drink it more constantly, than any other class of people. 2. The rate of deaths among brewers is lower by forty per cent than the average death-rate among the urban population of the groups of ages corresponding with those to which brewery-workmen belong. 3. The health of brewers is unusually good: diseases of the kidneys and liver occur rarely among them. 4. On an average, brewers live longer, and preserve their physical energies better, than the average workmen of the United States. The writer claims that beer is a perfectly wholesome drink, and, in support of this claim, refers to investigations made in Belgium, France, Holland, and Switzerland. He quotes also from the report made by a sanitary commission appointed by President Lincoln to examine the camps of the Union army and their sanitary condition. In examining the condition of regiments in which malt-liquors were freely used, the commission found not only that beer is a healthy beverage, but that it possesses hygienic qualities which recommend its use for the prevention of certain diseases. Mr. Thomann states, that, wherever the effects of the use of beer upon the human body have been examined methodically by competent physicians, it was found, to use the words of Dr, Jules Rochard of the Académie de médecine of Paris, "that beer is a very healthy beverage, which helps digestion, quenches thirst, and furnishes an amount of assimilable substances much greater than that contained in any other beverage."

The charge is often made that American beer is composed of so many poisonous ingredients that it is thereby rendered unfit for consumption; that, while pure beer may be harmless, such beer as is supplied by brewers at the present time in this country is positively injurious. This is met with a reference to the report of the New York state board of health, in which it is stated that an analysis of four hundred and seventy-six samples of malt-liquors had been made, and that they were all found perfectly pure and wholesome, and to contain neither hop-substitutes nor any deleterious substances whatever.

The most interesting portion of Mr. Thomann's pamphlet is that which deals with the statistics of the physicians under whose professional care the men employed in the breweries are placed. About five years ago the brewers of New York, Brook-

lyn, Newark, and the neighboring towns and villages, established a benevolent bureau for the relief of their sick and disabled employees. Physicians are appointed, whose duty it is to attend the sick members of the bureau, and a record is kept of all cases of sickness and death which occur. The number of deaths which took place among 960 brewery workmen in five years was 36, — an average of 7.2 per annum, or a death-rate per 1,000 of 7.5. The United States census gives the rate per 1,000 of the urban population of the same ages, as 12.5; or, in other words, the risks incurred in insuring the lives of habitual beer-drinkers are less by forty per cent than the ordinary risks of such transactions. The death-rate per 1,000 in the regular army of the United States in 1885 was 10.9; so that, even as compared with the soldier in peace time, we find that the brewery workmen have a great advantage in point of low rate of mortality.

Mr. Thomann gives us a number of interesting facts connected with the breweries and the workmen engaged therein. In every brewery is a room, called the 'Sternenwirth,' in which beer is constantly on tap, to be used by every one at pleasure and without cost. Every one drinks as much beer as he thirsts for, without asking, or being asked any questions as to his right to do so. The average daily consumption of malt-liquors for each individual is 25.73 glasses, or about ten pints. In the statistics which are given we find that a considerable number of the men consume forty and fifty glasses a day, and two are reported as drinking, on an average, seventy glasses daily. With a view to ascertaining, in the most reliable manner possible, the effects of the use of malt-liquors, the physicians of the benevolent bureau examined one thousand of the brewery workmen as to general state of health, condition of liver, condition of kidneys, and condition of heart. In addition to this, they weighed and measured each man, and tested his strength by the dynamometer. These examinations showed that there were, in all, twenty-five men whose physical condition was in some respect defective; and the remaining nine hundred and seventy-five enjoyed exceptionally good health, and were of splendid physique. There were 300 men who had been engaged in brewing from five to ten years, 189 from ten to fifteen, 122 from fifteen to twenty, and 46 more than twenty-five years. One special case referred to is that of a man fifty-six years of age, uninterruptedly at work in breweries during thirty-two years, who drank beer throughout this time at the rate of fifty glasses per day, yet has never been sick, and to-day is perfectly healthy, vigorous, and active.

The statistics are, to say the least, very surprising, and, unless refuted, will result in modifying to a considerable degree the generally accepted views of the influence of malt-liquors on the health of those who drink them habitually. Mr. Thomann has boldly thrown down the gauntlet, and we shall watch with interest to see who will take it up.

## THE ABORIGINAL MILLER.

DOUBTLESS it has occurred to many archeologists that the stone arrow-heads, knife-blades, pestles, axes, etc., in their collections are examples of but a small part of the articles once used by prehistoric peoples, the more perishable articles of wood, hide, or bone having long since disappeared. A study of the present arts of savage life — the surest safeguard in speculating about the arts of ancient times — proves this view to be correct, for the number and variety of implements of animal and vegetal origin now used in the camps of savage tribes greatly exceed those of stone. In the present article the implements of the aboriginal miller are introduced in illustration of what has been said above.

The tribes from which the illustrations are drawn are, the Hupa, of northern California (1), from the collection of Lieut. P. H. Ray, U.S.A.; the Pima and the Yuma stock, around the mouth of the Colorado River (2), from the collections of Edward Palmer; the tribes formerly east of the Mississippi (3); and the Utes of the great interior basin (4), from the collections of Major Powell and other officers; with glimpses of the Sioux and the Pueblo miller. It must be remembered that the active agent in all the varied operations of milling, among the savage tribes, — as well as of tanning, shoemaking, tailoring, weaving, the manufacture of pottery, and other peaceful industries, — is always a woman.

In describing the illustrations, I shall first refer to the sketches in plate 1. The Hupa, like all other primitive millers, has to gather the grist before she grinds it. For this purpose she uses a light but strong carrying-basket (fig. 5), made with warp of osier, and weft of the same material split and twined. A soft buckskin strap surrounds the basket, and passes around her forehead, which is protected by an ingenious pad (fig. 7). Her basket being filled with acorns, she trudges to her camp, and deposits them in a granary of closely woven, twined basketry (fig. 6). Her mill is both novel and ingenious, consisting of a pestle, a hopper, a mortar-stone, and a receiving basket-tray (fig. 9). The pestle is like its congeners all the world over; and the hopper has no bottom, its lower margin merely resting upon the mortar-


PLATE 1.
(1)
(2)


PLATE 2.
(3)
(4)

stone, to which it may or may not be united by means of pitch. Acorns are poured into this and hulled, and afterward reduced to meal. In those instances where the hopper is not fastened to the stone, the hulls remain above, and the powdered acorns sift down into the basket-tray. Water-tight baskets for 'stone-boiling' mush and for other culinary operations are made by this tribe. The mush-paddle of wood (fig. 1), the ladles of horn (figs. 2, 3), and the small stone paint-mortar (fig. 4), must not be overlooked.

The Pima or Cocopa miller (2) has for her outfit a carrying-net, a bean-crusher, a trough-mortar, a granary, and a 'metate,' besides a great variety of pottery, which the Hupa does not make. It may be mentioned here that none of the great Tinné stock, to which the Kutchin, Athapascan, Apache, and Navajo belong, seem to have made pottery at any time. The bean-crusher (fig. 10) is a cone of coarse strong wattling set in the ground. It is carried to the bean-trees, and in it the pods are broken up by means of a long wooden pestle (fig. 12), so that the miller can get a heavier load into her net. In other words, her 'first process' is crushing the pods in the field. The carrying-net of these tribes is most ingenious, consisting of four frame-sticks, a hooped rim, and a net woven in a very curious and difficult stitch. Besides the net, there is a back-pad made of palm-leaf, a padded head-band, and a forked rest-stick, which the harvester-miller uses as a cane when carrying her load. The gathered beans are stored in bee-hive granaries (fig. 16) of various patterns, made of straw sewed in a continuous coil by means of tough bark. The 'second process' is the reduction of the broken pods to coarse meal in a wooden trough or mortar (fig. 13). The last process is that of the 'metate,' or mealing-slab (fig. 15). The jars for holding the meal (fig. 14) are cream-colored, decorated in black. In summer the miller works in an open shed (fig. 17), but in cooler weather she transfers the scene of her operations to a mud-covered, wattled hut (fig. 18).

Let us now turn to plate 2. In the eastern part of the United States are found multitudes of well-wrought pestles, such as those shown in fig. 3; but there is a scarcity of good mortars from the same section. This scarcity can be accounted for by the fact that the mortars were perishable, being made of wood. It must not be forgotten that this is the region of maize (fig. 2) and hominy, and until very recently the hominy-logs or wooden mortars (fig. 4) survived on our southern plantations. Even at the present day it would not be difficult to find them in use in the more remote regions. Mr. Schoolcraft gives an illustration (fig. 4), showing how the ingenious miller has invoked the elasticity of a limb to lighten her task, and it would be interesting to know whether the miller or the bowyer was the first to make use of this labor-saving device.

The Sioux Indians formerly dried buffalo meat until it could be reduced to meal or pemmican. The outfit of the Sioux miller then consisted of a bowl made of the toughest dried rawhide, and a maul (fig. 1). The stone head of this maul was bound to the slender wooden handle by means of a hood of rawhide, put on green and allowed to shrink. The Ute miller, living in the deserts of the great interior basin, has to utilize every kind of seed that will sustain life. Her set of tools includes a conical carrying-basket (figs. 8, 10), a gathering-wand (fig. 9), a fanning and roasting tray (fig. 7), and a 'metate,' or mealing slab (fig. 11). These mealing-slabs (figs. 11, 12, 13) are common in tropical and sub-tropical America. The conical basket is closely woven, with a buckskin bottom, and has a soft head-band for the miller's forehead. The gathering-wand is an open-work, spoon-shaped frame of twine basketry, and is used for beating seeds into the carrying-basket, as shown in fig. 8. The fanning and roasting tray is shallow, and shaped like a cream-skimmer. It is used to separate chaff from seeds, or to parch the seeds, which are put into the tray with a hot stone, and the whole deftly shaken together. The parched seeds are afterwards reduced to powder on the mealing-stone.

There is scarcely a tribe or people that does not invoke the services of the miller in some manner. Many tribes use a greater variety of stone implements than do those mentioned, and all tribes have their own separate devices for gathering, storing, and grinding provisions. Take the wood and other perishable substances away from these millers' outfits, and we have left an archeological cabinet. In a general and cautious way, add these articles and attachments of animal and vegetal origin to your collection of ancient milling-tools, and you will have a comprehensive notion of the milling methods in the olden times.

O. T. MASON.

## PARIS LETTER.

Two of the many posts formerly held by the eminent zoölogist Henri Milne-Edwards were recently filled by elections at the Academy of sciences and the Sorbonne. Milne-Edwards's successor in the former institution is M. Sappey, who was recently removed from his professorship in the medical school on account of his age. M. Sappey's principal competitor was M. Ranvier, the well-known histologist, who, it must be conceded, ranks higher as a scientist than his more fortunate

opponent; but, as M. Ranvier is a much younger man, he can afford to wait a little for another opportunity, and it is not likely that he will have to wait long. M. Sappey has always worked hard and honestly, preferring the laborious life of the scientist to that of the physician or surgeon. The competitors for Milne-Edwards's professorship in the Sorbonne were Prof. Yves Delage and M. Perrier, professor in the Museum of natural history. M. Delage, who was elected to the vacant professorship, is a very able young zoölogist.

M. Charbonnel-Salle has been appointed professor of zoölogy in Besançon. M. Duchartre's successor as professor of botany will probably be M. G. Bonnier, the son-in-law of M. van Toeghem, the able botanist of the Museum of natural history. This relationship is really the only reason for his election, as he has made no good personal investigations to speak for him. The comments and criticisms on the future professor's abilities and talents are most unfavorable.

Paul Bert's successor will most likely be M. Dastre, a good worker and a learned man, who was for many years the assistant of M. Bert. His researches concerning vaso-motor nerves are much valued. Professor Chauveau of Lyons has been appointed to the Museum of natural history in the place of M. Bouley, who died some time ago. He is a thorough physiologist, and has done much good work, especially on microbes and the physiology of the circulatory system. His appointment is highly approved, but it is regretted that he did not compete for the professorship left vacant by the death of Paul Bert. Some interesting elections will soon take place in the Academy of sciences to fill the seats of MM. Bert and Robin. Professor Ranvier will most likely be elected to Robin's place. For the other there will be two principal competitors, — Germain Sée and Charles Rochet. The latter gentleman has many chances, and his election would meet with general approval.

At a recent meeting of the Société de biologie, MM. Fontan and Ségard read an interesting paper on the applications of suggestion to therapeutics. The writers have collected a hundred cases in which they have availed themselves of the possibility of putting their patients into an hypnotic state, to suggest a partial or entire cure. Their conclusion is, that suggestion may be of great value in cases where disorders of the motor or sensory powers exist, or even where there are anatomical disorders affecting the circulatory or secretory systems, such as follow upon traumatisms or upon general diseases, such as rheumatic diathesis and others. They have employed hypnotic suggestion in cases of traumatic arthritis, cerebral shock, urethritis, dyspepsia, and acute rheumatism, with good results, in most cases having been able to effect a complete cure in from three to six sittings. It may be added that none of the patients were at all hysterical. From a perusal of the observations quoted by the gentlemen named, it would seem that the influence of the mind on the body is greater and deeper than has hitherto been imagined. The way in which MM. Fontan and Ségard operate is very simple. The subject is put into an hypnotic trance (only three per cent of the patients are refractory to this part of the process), and is told, for instance, that his knee (in a case of hydarthrosis or arthritis) will work easily and without pain, or that (in a case of dyspepsia) the most indigestible foods will be easily digested. Generally the cures have been effected in a progressive manner, the disappearance of one symptom being suggested at the first sitting, that of some other at the next, and so on.

A paper on skin-grafting from the frog to man was read at another recent meeting of the same society by Dr. Dubousquet-Laborderie. The experiment was tried in the case of a man whose feet had been burned by molten iron. On one of the wounds Dr. Dubousquet put four grafts of human skin; on the other, four grafts from the skin of a frog. All of them took firm hold on the wounds. The frog-skin grafts retained their peculiar color a few days, afterwards changing to the color of the human skin. The healing process progressed rapidly, owing in part to the strict antiseptic precautions taken.

Merlatti, the rival of Succi, has successfully completed his forty-days' fasting experiment, though the medical committee appointed to watch the proceedings were of opinion many times that the experiment ought to be abandoned, owing to alarming symptoms. Merlatti, however, was determined to persevere, declaring that nothing would induce him to eat a morsel of food before the appointed time. He is naturally a hearty eater, and had prepared himself for his long fast by devouring a whole roast goose. When he ended his fast the other day, his stomach, so long accustomed to entire rest, refused at first to retain food. Succi continues his experiment with entire success. These experiments, as well as others of the same nature, are all very well, but in none of them has sufficient proof been afforded that fair play prevailed from beginning to end. One doubtful or suspicious member in a committee is sufficient to render valueless the whole experiment. There is also the possible dishonesty of the fasters themselves, and it may be remarked that in no experiment of the kind hitherto performed has fraud been impossible.

A man who walks about the streets, and who receives crowds of visitors daily, may, by the aid of an intelligent friend, obtain food in spite of the strictest surveillance. On the other hand, in these experiments more attention ought to be given to variations in weight, hourly as well as daily, and also to the excretion of urea. If these points were carefully studied, interesting and useful facts could be learned, and a better control of the patient secured. Of course, these experiments of Succi and Merlatti have brought forward numerous imitators, and many Italians may be met here who profess to be able to fast three, four, or even six months. Some, like Succi, pretend to possess a marvellous liquor; others, like Merlatti, do not. There is one faster in Brussels, another in London, a third in Algiers, while others flock in to Paris from different towns; and the daily papers publish a great number of anecdotes of persons of all descriptions and ages and colors who have lived longer or shorter periods of time without taking a morsel of food. But these stories are not much believed in. Many comments have been drawn forth from medical quarters by the fasting experiments mentioned, M. Bernheim of Nancy offering the ingenious suggestion that they may be accounted for on a theory of 'auto-suggestion.'

A work of much interest was begun some time ago in Cairo, — that of disinterring the Sphinx of Giseh. According to the latest reports, about one-third of the sand in which it is embedded has already been removed. The fore-paws and the right side have been partially brought to view. The paws were not hewn in the stone, as the rest had been, but were built up of bricks, owing, no doubt, to the less solid nature of that part of the stone in which they would otherwise have been carved. Viewed from above, the disinterred part seems inharmonious, but a judgment as to the general effect cannot be formed until the sand is entirely removed. It may then prove to be of less harmonious proportions than such monuments generally are; and in that case, as M. Maspéro thinks, it must be ascribed to an age more remote than that of the pyramids.

The conseil général of the department of the Seine decided at a recent meeting that it would be necessary to create a laboratory for the study of contagious diseases of animals. This is for the special purpose of preventing diseased meat from being introduced and sold in Paris.

A curious lawsuit is pending before the court of justice of Paris. It is especially curious on account of the facts upon which it is based, the pretended discovery of a method of extracting considerable amounts of gold from buhr-stone, a siliceous stone of tertiary formation, very abundant in the neighborhood of Paris. One chemist has declared, that, by the aid of this new method, from three to two hundred and forty grams of gold may be extracted from each ton of stone. Another says he has found as high as five hundred grams per ton, besides silver and other metals. On the other hand, civil engineers say they have not found an atom of the precious metal in the stone. Three hundred dollars in gold would certainly seem a pretty good yield for that sort of rock; but the whole thing seems chimerical yet, and the people who have invested their money in the business say it does not pay at all. They do not believe in the method now, and have begun suit against the inventor to recover the coined gold he extracted from them.

Professor Lépine of Lyons has published in the *Semaine médicale* a paper on the physiological action of a newly discovered antipyretic or antifebrile, studied by MM. Cahn and Hepp of Strasburg a short time ago. This antifebrile does not affect the healthy organism when given in a fifty-centigram dose. If a greater quantity is given (double or treble the dose mentioned), there may be present some cephalalgia, with cyanosis. When given to feverish patients, it abates the fever in a marked manner. It must be given at the highest point of the daily rise of fever, or, better, an hour before, in case the precise moment is known beforehand. The dose of fifty centigrams is the one usually preferred. The patient derives great benefit, the body temperature remaining normal or low, the heart pulsating with the same or increased energy, with a general feeling of well-being present. Some very remarkable cures have been effected in cases of typhoid and malarial fever. Professor Lépine speaks very highly of the antifebrile in cases of feber dorsalis as an agent to be used when neuralgic pains — so very rebellious and troublesome to the patient — are present. One or two fifty-centigram doses are enough in most cases, and the pains disappear in about half an hour. This fact, a useful one to know, had not been heretofore noticed. V.

Paris, Dec. 20.

## NOTES AND NEWS.

THE administration of General Hazen as chief signal officer is to be credited with the organization and encouragement of our system of state weather-services, which is rapidly extending in all parts of the country. This work is especially in charge of Lieutenant Dunwoody, and local services are now established in Louisiana, Alabama, Nebraska, Mississippi, Georgia, Minnesota, Ohio (by legislative enactment, making an appropri-

ation of two thousand dollars per annum to equip and sustain it), Indiana, Tennessee, Iowa, Illinois, Missouri, New Jersey, Michigan, Kansas, and New England (under the auspices of a meteorological society). North Carolina, South Carolina, Pennsylvania, and Arkansas are in the process of organizing them. Dr. C. W. Dabney, jun., has been appointed director of the North Carolina, with headquarters at Raleigh; and the first number of his *Weather-review* for December last promises a successful service. Already a hundred and sixty-five towns and stations are informed of the daily weather-predictions, by special messages repeated from Raleigh; and at thirty-two of these points flag-signals of the new pattern are now displayed for public information. By combination of telegraph and post-office service, the announcement of cold-waves will be made very general. Local observation will also be attended to, and twenty-nine stations were to be equipped ready for record by the first of the year, besides eleven signal-service stations in and near the state. No funds are as yet appropriated by the state for cost of instruments.

— The report of Dr. Willis G. Tucker, analyst of drugs to the state board of health of New York, contains much that is of interest to the public, dealing as it does with the drugs which are daily prescribed by physicians in the treatment of disease. The total number of samples collected and examined was 194, of which 49.2 per cent were found to be of good quality; that is, to conform to the requirements of the U. S. pharmacopoeia; 29.2 per cent of fair quality falling not far below these requirements, and 19.1 per cent of inferior quality, some of them being entirely fictitious. The cream-of-tartar which was purchased at the drug-stores showed 96.24 per cent of purity, while that from the groceries was but 87.48 per cent, and one sample only 79.31 per cent. In addition to these, eight others were purchased at groceries and purported to be cream-of-tartar, but were, in fact, either grossly adulterated or entirely fictitious, being made up of acid phosphate of lime, starch, and sulphate of lime. Dr. Tucker's advice would seem to be, that, when pure cream-of-tartar is wanted, it should be obtained from the drug-store, and not the grocery. The vinegar sold at the groceries also comes in for condemnation. Dr. Tucker says that an article so largely used in the preparation of food ought to be both free from adulteration, and of good strength as well; but the results of the examinations so far made, show that here, as elsewhere, wide differences in quality exist. The addition of mineral acids is very uncommon; but much vinegar is sold which has been plentifully watered, and the greater part of that sold as cider-vinegar is a so-called white-wine vinegar colored by caramel, with perhaps some cider-vinegar added to give flavor. 85.2 per cent of the samples examined came below the legal requirement. The standard required is "not less than four and one-half per cent by weight of absolute acetic acid in all vinegars." Only 14.8 per cent of the samples tested contained the required amount, the highest percentage being 6.2, and the lowest 1.8, the average being 4 per cent.

— The crown and flint glasses of the great objective of the Lick observatory arrived safely at the summit of Mount Hamilton on Monday, Dec. 27.

— Since printing the article in last week's *Science* on 'The prisoners of the Soudan,' we learn by papers from Europe that Mr. Stanley offered his services to the English government to command an expedition to be sent to the relief of Emin Bey; that this offer was accepted, the expenses, estimated at $150,000, to be defrayed by the English and Egyptian governments. Mr. Stanley, immediately upon his arrival in England, after conferring with the English government, went to Brussels to obtain permission of the king of Belgium, as the head of the Kongo Free State, to undertake this expedition. Mr. Stanley goes directly to Zanzibar, thence to the south end of Tanganyika, and thence all the way by boats to Wadelai. The Belgium papers say that this is a much longer and more dangerous route than the one by the Kongo and the Arouhuimi.

— The *American railroad journal* and *Van Nostrand's engineering magazine* have been consolidated, now appearing as the *Railroad and engineering journal*, under the editorial management of M. N. Forney. The new monthly is devoted to the discussion of engineering and mechanical topics, with special reference to railroad construction and operation. The January number is well illustrated, and contains a good table of contents.

— The following are the recent assignments in the *personnel* of the coast-survey service. Asst. J. D. Baylor has left for Cedar Keys, Fla., to establish magnetic stations between that place and Washington, some seven or eight in number. He will finish the work about April 1. Asst. O. H. Titman and Mr. Henry G. Turner as aid have taken up the primary triangulation work from Alabama towards Mobile; Asst. J. B. Weir, Sub-Asst. McGrath, and Mr. W. D. Fairfield have left Washington to take up the transcontinental geo-

detic levels; and Asst. F. W. Perkins will organize his party about Jan. 15 for work on the south coast of Louisiana. All parties on the Pacific coast are out of the field, except those parties engaged in the resurvey of San Francisco Bay and vicinity. Early in April Assistant Pratt will take up the recognizance of the west coast of Washington Territory from Cape Flattery to Gray's Harbor, a very important work. The steamer Bache has arrived at Key West preparatory to entering upon field-work on the west coast of Florida.

— The Cosmos club of Washington held its first regular meeting for this year in its new clubhouse last Monday evening. The following officers were elected: president, Dr. John S. Billings; vice-president, Dr. John S. Yarrow; secretary, T. M. Chatard; treasurer, William Bruff; house committee, Mr. J. B. Marcou, Dr. John F. Head, and Mr. William Poindexter; library committee, Dr. S. M. Burnett, Dr. Newton S. Bates, and Mr. Joseph C. Hornblower. The proposition to increase the membership was postponed to a special meeting to be held Jan. 31.

— Governor McEnery of Louisiana has issued a call for an interstate convention in the interest of stock-raising, dairying, fruit-growing, and general agriculture, to be held at Lake Charles, La., on the 22d, 23d, and 24th of February, 1887.

— A curious affection exists among the horses of north-western Texas known as 'grass-staggers.' It is caused by their eating the 'loco-weed,' and the affected animals are said to be 'locoed.' At first they lose flesh, and then become weak and staggering, and finally crazy. The Indians believe that an insect is the cause of the disease; but Dr. Carhart of Texas, in a letter to the *Medical record*, says that he has examined the weed, but can find no insect life upon it.

— A remarkable specimen was presented some years ago by the curator of the British museum to the Zoölogical society of London. It was the body of a chicken whose beak and feet closely resembled those of a parrot. Several such instances occurred in the same poultry-yard, and were attributed by the owner to the fact that one of the hens had been frightened by a parrot. Many instances of deformity are on record in the human species, which are popularly attributed to maternal impressions received during the formative period. The number of these is so great as to have led physicians and others to look upon such results as something more than mere coincidences. In a recent paper read before the orthopedic section of the New York academy of medicine, Dr. T. L. Stedman discusses the influence of maternal impressions in the etiology of congenital deformities, and produces evidence which seems to indicate that there are laws in development which are as yet but partially understood, and which, when thoroughly investigated, may explain these remarkable instances to which we have alluded, and of which Dr. Stedman gives many striking examples.

— The presence in New York City of a number of cases of beri-beri, or kak-ke, has re-awakened medical interest in this peculiar disease. The patients came from San Francisco by vessel, and three of them were taken to Bellevue hospital. Two of these died. On the voyage, most of the crew were affected with the disease, and some of them fatally. This affection prevails in Japan, India, South and Central America, and in the islands of the Gulf, and is technically considered to be a multiple neuritis, or an inflammatory condition of the nerves. As a rule, the spinal nerves alone are implicated, but occasionally the cranial nerves as well. It has been demonstrated with a great degree of probability by Cornelissen and Sugenoya that beri-beri is an infectious disease, the specific cause being a micro-organism resembling the bacillus of anthrax, which is found in the blood, muscles, and nerves. In the cases at Bellevue the nature of the disease was not recognized at a sufficiently early stage to enable the physicians to study the microbes, or to make any cultures of them.

— We are familiar in the east with tumbler-pigeons, and in the Central States there are curious beetles, that, from their habit of rolling along little balls of clay, have received the popular name 'tumble-bugs;' but it is upon the plains of the west that one of our common weeds is so modified by its environment, and forms habits so novel, that it loses its eastern name, and is known as 'tumble-weed.' According to C. E. Bessey (*Botanical gazette*, xi. p. 41), "upon the plains and prairies of the west our common weed *Amarantus albus* grows into a compact plant, whose stout, curving branches give it an approximately spherical form. The autumn winds break the main stem near the ground, and the upper part goes rolling and tumbling before the wind, often for miles. This is an excellent illustration of the effect of climate on the physical development of the plant-body, as in the east the species is a straggling herb, remaining rooted long after its death at the close of the season. Dr. Newberry has told us that it is also known as the 'ghost-plant' in allusion to the same habit, bunches flitting along by night producing a peculiarly weird

appearance. It is doubtless very efficient in the distribution of the seeds, and accounts for the wide dissemination of the species on the plains. Professor Bessey notes a similar habit in *Baptisia tinctoria* on Martha's Vineyard, Mass., and *Panicum capillare* might also be cited as another example."

## LETTERS TO THE EDITOR.

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Atmospheric lines in the solar spectrum.

EXCUSE me; but in Professor Pickering's note on p. 13 of *Science* for Jan. 7, have not the types twice made him change M. Cornu's name to 'Mr. Conner'? If so, you best know whether the misprint be worth your correcting, though it was a very natural one for the printer to make. JAMES EDWARD OLIVER.

Ithaca, N.Y., Jan. 9.

### A hairy human family.

The abnormal growth of hair, that has been not rarely observed since antiquity in individuals of different races of mankind, presents various points of interest other than anthropological ones. As Professor Mason has stated (*Science*, ix. No. 205), its recently recognized cause is the persistence of the prenatal downy hair, 'lanugo' as it is called, and its rich growth through life; or rather, to speak more accurately, the non-development of the hair-follicles to adapt them to the growth of normal hair. This persistence of the embryonal covering is most strikingly shown, as a normal condition, in the ostrich (Ratitae), Apteryx, and penguin, where the hair-follicles, or, what is anatomically the same, the feather-follicles, produce through life the soft downy plumage of the chick only. This loss of the foetal hair, which takes place with the general exfoliation of the cuticle during the first year of life, is not characteristic of man, but occurs in many other, though not all, mammals. Wiedersheim (*Vergl. anat.*, 31) sees in this lanugo, and its abnormal development in the 'hair-men,' a probable evidence of an abundant covering of hair at some early period of man's ancestry.

The extent to which this abnormal growth of the downy hair may reach will be better appreciated from the picture, here given, of Teftichew (or Testichew), the elder Russian 'dog-man,' than can be from any description. The 'animal' or dog-like appearance in this case is more striking than in any other of which I have seen illustrations, though the Amras family of the sixteenth century presented a very similar aspect. In this family, the father, son, and daughter were all covered, according to the paintings and descriptions now extant, over the entire body with long hair, with the exception of a space below the eyes.

In the notable case of Julia Pastrana of Mexico, a most repulsive-looking person in her picture, the hair of the head, forehead, and face, was coarse like ordinary hair, and her cheeks and nose were nearly bare. She died in 1860, in giving birth to a son, who early showed similar hairiness on head and face. The prenatal hair is not necessarily soft and downy. Pathological conditions will cause it in places to be coarse, like that of the adult; and cases are known where the larger part of the body has remained through life covered with a thick coat of strong hair, due, in reality, to an enormously large mother's mark. A similar condition is found in the coarser and more bushy growth of the beard from long-continued neuralgia or nerve-irritation.

Yet another point of interest is the undoubted

JULIA PASTRANA.
ADRIEN TESTICHEW.

tendency to heredity which these abnormal cases show. Thrice has the anomaly been known to be developed in the second generation; and once, the Birman family, in the third generation. On the other hand, the precisely opposite condition, that of absolute hairlessness from prenatal causes, not a few cases of which have been observed among different

races, shows the same tendency to heredity. Likewise, supernumerary fingers, toes, teeth, and breasts in both male and female, and the presence of a short tail, are all undoubtedly capable of hereditary transmission.

The thinly haired African, or the hirsute Tasmanian, as also the great variations in the pilosity of the civilized races, present questions more within the province of the anthropologist; bearded females and beardless males, that of the physiologist, or, possibly, of the suffragist. S. W. Williston.

New Haven, Conn., Jan. 8.

## Fort Ancient, Warren county, O.

Following the letter of Mr. Cyrus Thomas in *Science*, No. 201, if Fort Ancient be of as late date as he there suggests, an explanation of its uses, and of the fact that the *débris* which usually marks the site of prehistoric villages is entirely wanting in and about the work, may possibly be found in the river-valley both above and below the fort. The Little Miami valley is, for twelve or fifteen miles north of Fort Ancient, very rich in the remains either of the mound-builders or Indians, or both if they be distinct races. Upon the bluffs and in the surrounding high lands are numerous mounds, many of them of considerable size.

In almost every gravel-pocket which has ever been opened on the river-hills have been found human bones. In several places in the valley are burial-grounds, often of many acres, where the interments were as regularly ordered and as closely crowded as in a modern military cemetery. Pottery, celts, pipes, etc., are frequently found with these remains. On a high bluff about eight miles above Fort Ancient is said to be the site of an ancient village of considerable extent, marked by an accumulation of broken and charred bones, mussel-shells, pottery, etc., varying in thickness from twelve to twenty inches. There are many reasons for believing that the valley for many miles above the fort was not only densely peopled, but that these people were permanent residents.

Recent 'finds' of copper and other implements about the town of Morrow, eight miles below Fort Ancient, give weight to the supposition that the river-valley was peopled in that direction also, and that the work in question served as a refuge or fortress, situated near the centre of a populous and powerful community. I merely make the suggestion that the numerous remains hereabout may have some relation to the origin and purposes of Fort Ancient.

Chas. A. Hough.

Waynesville, O., Jan. 10.

The remarks by Professor Thomas in *Science* for Dec. 10, 1886, remind me that in the spring of 1870 I made a rapid inspection of Fort Ancient, walking completely around its circumference. My sketch shows several corrections and additions to Dr. Locke's map as published by Squier and Davis, notably the long stone steps leading down to the water's edge. My original map is now in the archives of the Ohio historical society in Cincinnati. A general account of my visit was published at the time in the Cincinnati *Commercial*.

It seems to me plausible, that, if this was not a fortified town, then, in the organization of the mound-nation, there may have been, in the latter days of its existence, a distinct standing army, and that this fort was occupied by such army only for the purpose of protecting the community living in the rich valleys to the southward against the hordes invading them from the north. Cleveland Abbe.

Washington, Jan. 12.

## Star rays and the corona.

Mr. Randolph's communication a few weeks ago escaped my attention at the time of its appearance. The difficulties to which he refers may be due partly to the structure of the human eye. Dr. LeConte has resolved that relating to the phenomenon of long rays or streamers appearing around an electric light, due to refraction rather than reflection at the exterior surface of the cornea next the eyelid. The appearance of short rays around a star, Mr. Randolph will find explained in Helmholtz's 'Popular scientific lectures,' pp. 217–219, and an instructive diagram in the same author's 'Physiological optics,' French edition, p. 34, or German edition, p. 24.

Telescope lenses have been made greatly superior to the human eye as an optical instrument. Whatever may be the final explanation of the solar corona, the number of chances is almost infinite that it will *not* be referred to defects in the structure of telescope lenses and tubes. W. LeC. Stevens.

Brooklyn, Jan. 7.

## To authors of text-books on physics.

Recently, in examining students for admission to college, the writer was again reminded of a small, but, as far as his observation goes, universal error in text-books on physics. It is stated that "the velocity of sound varies as the square root of the *elasticity* divided by the density." In illustration, it is usually stated that the velocity in air is about 1,000 feet, in water about 4,000, and in iron about 8,000. The first two are perfectly elastic, and the second is the more dense: hence, by the rule, the velocity in water should be less than in air. Iron is less elastic and more dense than either of the others, and hence, by the rule, the velocity should be least. The rule will be correct if for 'elasticity' we read 'co-efficient of elasticity,' which may be defined as the force which would double the length of a bar, or compress a liquid or gas to half of its volume. I. O. Baker.

Champaign, Ill., Jan. 8.

## The swindling geologist.

The swindling geologist was this week in Springfield, Mass., where he passed himself off as Capt. C. E. Dutton. I cannot learn that he succeeded in victimizing any one except the hotel-keeper of the house where he stopped, owing to the fact that he was early exposed by the commanding officer of the armory, who luckily happened to know Captain Dutton.

He later inflicted himself on me, playing the deaf-mute, calling himself Ivan C. Vassile of the Russian museum, and offering to sell me odd volumes of Hall's 'Geology of New York state.' Suspecting that they were stolen, I declined to buy.

He is a square-faced, smooth-shaven, light-complexioned fellow, of rather short stature, and wore a white felt hat and an army cape. His names and clothes, however, would perhaps hardly serve to

identify him, as he probably has a variety of both. He claimed to be on his way to Albany.

Perhaps if he can be exposed all along the line, he may soon be rendered harmless. F. W. STAEBNER.

Westfield, Mass., Jan. 8.

## The West Indian seal.

Mr. Henry L. Ward, a son of Prof. Henry A. Ward of Rochester, N.Y., has recently returned from a special trip to the Gulf of Mexico in search of the little-known West Indian seal, Monachus tropicalis, bringing with him a good series of skins and skeletons, including those of both sexes and a suckling. Professor Ward, who has been on the alert for several years for this, until recently, almost mythical species, on learning of the probable locality of a small colony of them, promptly organized, with his usual energy in such matters, an expedition to procure specimens, in which enterprise he was joined by Mr. Fernando Ferrari-Perez, naturalist of the Mexican geographical and exploring commission, who, with Mr. Ward, procured a schooner at Campeachy for a trip to the three little keys north-west of Yucatan known as The Triangles (Los Triangulos). Owing to bad weather, they had but three days at the keys, but their efforts were well rewarded; and the West Indian seal is now in a fair way to be soon represented in several of our leading museums. The only specimens hitherto known to be extant in collections are the one recently acquired by the U. S. national museum (see *Science*, iii. 752), and the imperfect skin without skull presented many years ago by Mr. P. H. Gosse to the British museum. So little was known of the species until recently, that even its generic relations were in doubt, its reference to the genus Monachus having been regarded as provisional.

The material obtained by Mr. Ward, at much risk and expense, having been kindly placed in my hands for description, I am able to throw some further light upon this interesting species. Its cranial as well as external characters show it to be unquestionably referable to the genus Monachus. The color of the animal proves to vary much with age. The young are at first wholly intense black, remaining of this color doubtless during their first year. As they become older, the color changes to lighter; the dorsal surface becomes grayish black, through a slight gray tipping to the black hairs, shading on the sides of the body into the yellowish white of the ventral surface. The front and sides of the muzzle, and the edges of the lower lip, become yellowish brown; the whiskers change from black or blackish to yellowish white, a few only of the shorter ones remaining dark, either wholly or only at the base. In the younger animals the whiskers are not only much darker than in the adult, but much longer and heavier.

The skull is depressed, broad, and heavy. In general proportions it differs from that of Phoca vitulina in the longer, more sloping, and much broader ante-orbital portion, and the much greater thickness of the inter-orbital region, and the auditory bullae are less swollen and relatively much smaller. The dentition is very heavy, the length of the largest molars being 16 mm., with a breadth of 10 mm. The molars are crowded, set somewhat obliquely to the axis of the jaw; the second, third, and fourth have one small accessory cusp before, and two behind, the larger or principal one. These are well marked in the younger or middle-aged specimens, but become worn and even wholly obliterated in old age. Gray's description of the dentition of the Mediterranean species (M. albiventer) applies in every particular to that of the present species.

The nails of the fore-feet are large and strong, the largest being from three-fourths of an inch to an inch in length; those of the hind-feet are rudimentary, being reduced to minute horny points, scarcely visible except on close examination.

The flat skin of the full-grown male measures about seven feet in a straight line from the end of the nose to the point of the tail, the free portion of which latter has a length of three inches. The adult female has a length of about six feet.

Mr. Ward obtained a young one only a few days old, and found nearly ripe foetuses in several of the females taken. This would indicate that the young are born in December.

The Triangles are about a hundred and fifty miles from the Alacrane Reefs, where the species was found in abundance by Dampier about two hundred years ago. Small colonies doubtless still exist on the uninhabited reefs and keys of the Gulf of Mexico and Caribbean Sea. It has been met with off the coasts of Cuba and Jamaica, and has been reported as an occasional visitor to the Bahamas and the Florida Keys.

Mr. Ward calls my attention to the fact that Columbus not only met with it in the West Indian waters, but that his sailors killed these seals for food, nearly four hundred years ago. It is therefore a remarkable fact that the first discovered American seal should be the latest one to become known satisfactorily to science.

The present notice is preliminary to a more elaborate account of the species now in preparation, which will be illustrated with plates of its osteological and external characters. The American museum of natural history of this city has secured skins of an adult male, an adult female, and a young example, and a fine adult male skeleton, which will soon be mounted for exhibition. J. A. ALLEN.

New York, Jan. 6.

## Early forms of writing.

Your remarks (*Science*. viii. No. 202) on Dr. Brinton's paper relating to the early modes of writing must form my excuse for this note.

I have made some discoveries, since the publication of my 'Notes on certain Maya and Mexican manuscripts,' which seem to confirm Dr. Brinton's opinion that the mode of writing which he designates the 'ikonomatic system' was practised to some extent by the Maya scribes, — a fact I had noticed previous to seeing his paper. For example: I find on plate xvii. of the Codex Troano the name of a bird (*Kuch*, in Maya) designated by a compound hieroglyph consisting of two parts, one of which is Landa's letter-character *Ku*, the other the symbol for the cardinal point west, or *Chikin* (according to Rosny). The name of another bird (the quetzal or *Kukuitz*) is denoted simply by a duplication of Landa's *Ku*. A few other characters formed in the same way have been discovered. But, so far as determined, most of the characters are symbolic, where the object intended is designated by a single characteristic, the head being the part or feature usually selected to represent persons and animals. For ex-

ample: a human head with one or two curls of hair signifies a female; deities, as shown by Schellhas, are represented by the head with the peculiar features found in their figures. The bird above mentioned (*Kuch*) is generally represented by a head, with certain lines about the eye, used in the complete figure to indicate the species. An idol is denoted by the character a head, which Dr. Schellhas erroneously supposes to be the symbol for a certain deity. The symbol for game quadrupeds is a rabbit's head mounted on the *Kan* or corn symbol; that for game-birds, a turkey's head on the corn symbol; etc.

Inanimate objects are usually denoted by conventional symbols having as the chief idea some characteristic of the thing represented. For instance: the symbol for house, or hut, found in all the codices, has as its chief characteristics broken lines indicating the thatching, and perpendicular lines suggesting the posts.

I have determined the signification of one character in which color plays a part. This is the symbol for *Ekchuah*, the god of pedlers or travelling merchants. This is a basin-shaped character, indicating the half of a calabash (*Chu*, in Maya), surrounded by a heavy shading of black (*Ek*, in Maya). It is found accompanying the black deity in the Troano Codex.

A few of the written characters are truly phonetic, but my scant knowledge of the Maya language renders progress in this branch of the subject slow. That there are no true letter-characters, as supposed by Landa, must be conceded. I may add, in closing, that I have discovered in the Cortesian Codex the origin of this author's '*A*.' It is the symbol used to denote the turtle (*Aac*), the conventional representation of the head of this reptile, and is in no sense phonetic.

A paper explaining these and other discoveries has been prepared for the bureau annual, and is now in the hands of the printer. CYRUS THOMAS.

Youngsville, Penn., Jan. 10.

## On the coloration of mammals.

I desire to call attention to the arrangements of the color-marks on the skin of mammals, and to attempt to show that some of them are correlated to the distribution of nerves and to the positions of the muscle-masses of the body.

The white stripe on the side of the trunk in Tamias is the region of distribution of the superficial branches of the intercostal nerves and those nerves in serial homology with them.

The white patches on the muzzle of the tiger answer to the distribution of the infra-orbital nerves.

The single black stripe on the withers of Equus taeniopus lies near the centre of the region of the scapula. In the tiger the abdominal stripes are in the same series with those on the flank. In the locality last named they range over the muscles and the depressions between them without regard to the anatomical conformation of the parts. On the anterior extremity it is quite different. In the lioness the depression between the radial extensor mass and the flexor mass is marked at the distal end of the region with a longitudinal black stripe which is about one-fifth the length of the fore-arm. The skin over the extensors of the carpus is marked by a number of spots, and that over the flexor mass by a few transverse bars. The contrast between the two divisions of the fore-arm is decided.

In both the lioness and the tiger the cervical mass and the gular region are separated by differences in coloration. Two oblique stripes are seen limited to the cervical mass. The depressions between the acromio-cephalic and the brachialis anticus muscles are marked by black stripes.

The general distribution of the spots and stripes on the skin over the scapula, and the muscles which are inserted into it and over the extensor aspect of the anterior extremity, form a separate group from those of the rest of the trunk.

The line of the malar bone of the tiger is distinguished by a broad, irregular bar. A more slender one lies vertically over the masseter muscle.

In addition to the above, it is found that the wrinkles and folds in one animal answer to the permanent skin-bands or pigment-lines in another. The dorsi-facial folds of Phacochoerus are in the same positions as the pigment-lines in the zebra The bands on the trunk of the nine-banded armadillo are the homologues of the transient folds of skin seen in the instantaneous photographs of the hog taken at the time when the limbs of the same side are at the nearest point one to the other.

The medio-dorsal stripe which is so often met with in mammals is probably a sequence of the general deep-lying cause which determines the longitudinal type of the vertebrate form.

The disposition for the neck, withers, and the anterior limb to be more hairy than is the remainder of the trunk, is probably associated with the localization of the marks on the anterior extremity being better marked than are those on the posterior. The fore-limb has connections with the head as exact as with the dorsum as far back as the origin of the latissimus dorsi. In the bison the shaggy surface corresponds quite accurately to the proximal part of the fore-limb and its extrinsic muscles.

A mammal, in leaving the ground, from the hind-limbs hunches up the withers in a conspicuous manner. This region is more thickly haired and more brightly colored in many bats than is the rest of the trunk. Now, in the bat the shoulders and neck are permanently hunched, for the fore-limbs are scarcely at all used for support. HARRISON ALLEN.

Philadelphia, Jan. 4.

## Butterflies in southern Connecticut.

During the summer and autumn of 1884 and 1885, I was collecting butterflies in southern Connecticut. In the first season I found Pyrameis cardui very abundant, P. huntera comparatively rare, while of P. atlanta I saw only two specimens, both of which I secured. The next summer, on precisely the same ground and in the same time, I took all I wanted of P. atlanta, only two of the huntera, while I did not see a single specimen of P. cardui. I should be glad if some one would explain this. I do not imagine my collections could have been extensive enough to seriously affect the abundance of any of the species in the locality.

I might also say, that, of a large number of specimens of Argynnis idalia taken in the two seasons, a very great majority were females; and of the males, not one was in a perfect condition, most of them being badly torn and much faded. This would seem to indicate that they appeared before the females.

L. N. JOHNSON.

Evanston, Ill., Jan. 8.

## Calendar of Societies.

*Anthropological society, Washington.*

*Jan.* 4. — Victor Mindeleff, The Moki group of Pueblos; William H. Holmes, Prehistoric jewellers of Panama; J. Owen Dorsey, Indian customs around the sick and dead.

*Institute of social science, New York.*

*Jan.* 13. — George Gunton, Economic heresies of Mr. Henry George.

### Publications received at Editor's Office, Jan. 3-8.

**Bainbridge**, Elizabeth G. Schoolroom games and exercises. Chicago and Boston, *The interstate pub. co.*, 1886. 135 p., illustr. 12°.

**Baird**, S. F., Report of, to Smithsonian institution for the year 1885-86. Washington, *Government*, 1886. 83 p. 8°.

**Billings**, J. D. Standard selections for elocutionary drill and memory work in grammar and high schools. Chicago and Boston, *The interstate pub. co.*, 1886. 135 p. 12°.

**Bovallius**, C. Nicaraguan antiquities. Stockholm, *P. A. Norstedt & Söner, pr.*, 1886 50 p., 41 pl., 2 maps. f°. (New York, Charles L. Woodward, $8.)

**Cleveland** public schools. Superintendent's report for the school year ending Aug. 31, 1886. Cleveland, O., *Plain dealer pub. co.*, 1886. 125 p. 12°.

**Ferrel**, W. Recent advances in meteorology. (U. S. war dept., appendix 71.) Washington, *Government*, 1886. 440 p., illustr. 8°.

**Fitzgerald**, D. Evaporation. New York, *Amer. soc. civ. eng.*, [1887.] [66] p., [12] pl. 8°.

**Hall**, E. H. Elementary ideas, definitions, and laws in dynamics. Cambridge, *C. W. Sever*, 1886. 4+37 p. 12°.

**Ingalls**, J. K. Economic equities: a compend of the natural laws of industrial production and exchange. New York, *The truth seeker company*, 1887. 63 p. 12°. 25 cents.

**Ingersoll**, R. G. A lay sermon. New York, *The truth seeker company*, 1886. 25 p. 16°.

**Putnam**, J. P. Reply to the report of Mr. Glenn Brown on experiments in trap siphonage, at the Museum of hygiene, U. S. navy department, Washington, D.C. Boston, *The author*, [1887.] 12 p., illustr. 8°.

## Advertised Books of Reference.

# SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 14, 1887.

## *ON THE ENRICHMENT OF THE SOIL BY THE CULTIVATION OF 'ENRICHING CROPS.'*

It is an observation almost as old as agriculture, — certainly much older than the earliest literature of agriculture, — that certain crops appear to increase the fertility of the soil upon which they are grown; or, to state the case more accurately, they exert a favorable influence upon the growth of the succeeding crop. Red clover is the typical example of such a crop; and the use of this plant as a means of renovating poor or exhausted soils is co-extensive with improved agriculture. Other crops, on the contrary, have an opposite effect, and are denominated exhausting, as, for example, the cereals.

But while the facts just recounted are sufficiently well known, their cause or causes are by no means so well made out. The first attempts at explanation naturally assumed that the exhausting crops took more from the soil than the enriching crops, or, what amounts to the same thing, that the latter were the medium of conveying materials from the atmosphere to the soil. The enriching crops were also supposed to improve the soil by facilitating the direct acquisition of material by the soil from the air, accomplishing this by shading the soil, by the mechanical action of their roots, and also, in case of root-crops, for example, by the tillage necessary for their cultivation.

Thaer and his school, to whom we owe these attempts at explanation, considered the humus of the soil to be the real food of the plants, and the mineral matters to be unessential, and naturally found support for their hypotheses in the great increase in the organic matter or humus of the soil consequent upon the growth of such a crop as clover, for example. As the progress of investigation brought about a better understanding of the laws of vegetable nutrition and the sources of plant-food, these views as to the action of enriching crops were gradually modified; but they continued, and still continue, to follow the general lines laid down by Thaer. We now know that the plant obtains from the soil its mineral ingredients and its nitrogen, while the bulk of its 'organic' matter is assimilated by its leaves. It is plainly impossible that a crop should enrich the soil in mineral matters. All crops enrich the soil in carbon to some extent, since their roots and stubble remain in the soil; but this carbon appears to be of no *direct* use to the plant. There remains only the nitrogen, and the modern theories of the action of enriching crops are based on the belief that they somehow increase the store of nitrogen in the soil. Indeed, if we substitute nitrogen for humus in Thaer's hypotheses, we have very nearly the views of recent authors.

Before proceeding to discuss these views, however, it will be well to inquire whether this supposed enrichment of the soil is a fact. The benefits of a judicious rotation of crops are undoubted, but they are susceptible of a variety of explanations. A crop like clover, for example, may promote the growth of a succeeding grain-crop in a variety of ways, having no relation to the stock of nitrogen in the soil. Only careful scientific experiments can decide whether such crops actually enrich the soil in nitrogen. Unfortunately, but few experiments upon this subject have as yet been made, and some of those reported are of doubtful value. Considerable interest, therefore, attaches to the experiments made by Strecker in the year 1883–84 at Göttingen, an account of which has recently been published,[1] along with a very complete review of the literature of the subject.

Strecker experimented upon plants and soils in pots, lupines serving to represent the legumes, and oats the cereals. But one of the vegetation experiments of 1883 succeeded; viz., one with lupines in unmanured sand. From the data given, it appears that the soil and roots remaining in the pot contained only about 40 per cent of the nitrogen originally present in the sand, or introduced in the seed or in the rain to which the pots were exposed. On the other hand, the amount thus removed from the soil was only about 39 per cent of the total quantity found in the aerial portions of the plants: the remaining 61 per cent, therefore, must either have been assimilated directly from the atmosphere or been absorbed from it by the soil. Six pots without plants were also exposed during the summer; and these showed, without exception, a considerable loss of nitrogen, which, as there was no drainage from the pots, must have passed off into the air. Two of the pots contained unmanured sand with 0.0015 per cent of nitrogen; and the variations in these were evidently within the limits of analytical error and of

[1] *Journ. f. landw.*, xxxiv. 1.

no significance. The other four pots contained the same sand manured with bone-dust, and these showed an unmistakable loss of nitrogen. This loss, of course, was from the manure rather than from the soil, and it seems probable that it was due to the loss of nitrogen in the free state during decay which has been shown to occur by Reiset, Lawes and Gilbert, König and Kieson, Dietzell, Morgen, and others, including the writer. At the same time, these results show that this loss may take place under the circumstances in which organic matter exists in the soil or in the added manure. Strecker observed that the loss was less when the soil was stirred on the surface than when undisturbed, and greater in the sun than in the shade. He explains the former fact by the hypothesis that the loosened soil absorbed ammonia from the air more freely than the compact one, and thus made good part of the loss just noted.

The experiments of 1884 were made partly in glass pots, and partly in zinc boxes. Both stood under cover, protected from both rain and dew. Some were filled with sand, and some with garden-soil. As before, lupines and oats were used as experimental plants, and pots were also left without plants for the purpose of observing the loss of nitrogen noted in the previous year's experiments.

Strecker's principal conclusions from his results were as follows: —

1. A naked soil exhales during the summer considerable quantities of nitrogen. The loss is greater from compact than from stirred soil. The results of the experiments of 1884 upon this point were of the same character as those of 1883; that is, the results in the sand alone are of no significance, while those in the manured sand show in reality a loss of nitrogen by the manure. In addition to this, however, one of the pots with garden-soil showed an unmistakable loss of nitrogen.

2. If the soil is occupied by oats or lupines, this loss of nitrogen is diminished. Some loss was still observed in most cases; but when lupines were grown in unmanured sand, the results, calculated on the basis of the minimum percentage of nitrogen originally found in the sand, showed a gain of nitrogen by the soil and roots. An unmistakable increase of the nitrogen of soil and plant over that of soil and seed was noted in several of these trials in unmanured sand.

3. In all cases in which the soil was tolerably rich in nitrogen, less nitrogen was found in it after the growth of a crop and the removal of the aerial portions than was present at the beginning of the experiment: in other words, there was no enrichment of the soil.

4. No essential difference was observed between lupines and oats. Both drew their supply of nitrogen from the soil, and, in most if not all cases, left it poorer than they found it.

It will be seen that Strecker's experiments give little countenance to any hypothesis of a gain of nitrogen from the atmosphere. In this respect they differ from the results reported by Atwater.[1]

The latter experimented upon peas grown in sand and watered with a solution of plant-food, and found in nearly every case much more nitrogen in soil and plant than was supplied in seed and nutritive solution. His results, however, do not bear directly upon the question under discussion, because he removed the whole plant, including the roots, from the soil, and determined only the total nitrogen in roots and tops and the residual nitrogen of the soil. It would seem, however, that, if plants can gain so large a proportion (up to 50 per cent) of their nitrogen from the air as they did in these experiments, they might very well enrich the soil in nitrogen through their roots and stubble. Strecker's experiments are very interesting as regards the relations of soil and plant to the nitrogen supplies of the atmosphere, but they are entirely inadequate to explain the functions of 'enriching crops' in agriculture. Pot experiments, while they permit any exchange of nitrogen between crop and atmosphere to be accurately observed, practically assume that the soil ends at the depth of ten or twelve inches, and take no account of the subsoil as a source of nitrogen. They thus ignore a factor of great importance, and one which affects the question in two distinct ways. In the first place, large amounts of nitrates may escape into the subsoil with the drainage-water. I have discussed in an earlier article (*Science*, iii. No. 48), the results of experiments by Lawes and Gilbert and by Dehérain, bearing on this subject, and have shown that the deep-rooting leguminosae, which have a long growing-season, have an important function in arresting these nitrates, and storing them up in an insoluble form, to be set free again gradually for the use of a succeeding crop. According to Lawes and Gilbert, it is at least probable that the roots of clover in some way serve to convey the nitric ferment into the subsoil (which is naturally nearly destitute of it), and thus indirectly convert the insoluble nitrogen compounds there present into nitrates, which they then proceed to assimilate.

In the second place, it would appear that clover and similar deep-rooting plants may bring up nitrogen from the subsoil and deposit it in their upper roots and stubble. While the soil as a

[1] *Amer. chem. journ*, vi. 365.

whole is not enriched by this process, the surface soil is, and this concentration of nitrogen in a smaller soil area may greatly facilitate the growth of a succeeding shallow-rooting and quick-growing crop. Drechsler[1] has attempted to show that such an enrichment of the surface soil is impossible. He argues, that, since the roots develop chiefly where they find food, if they find their supply of nitrogen chiefly in the subsoil, they will develop chiefly there, and consequently will not enrich the surface soil. It is not difficult to show, however, that this reasoning is fallacious. It is no more difficult to conceive that nitrogen should be transferred from the subsoil roots to the surface-soil roots, if the latter found an abundant supply of mineral matters at hand, than it is to conceive that both nitrogen and ash ingredients may be transferred from the roots to the aerial parts of the plant, provided the latter find a sufficient supply of carbon dioxide. Let us suppose the surface soil to be absolutely destitute of nitrogen to the depth of six inches, and that the nitrogen of the seed is sufficient to supply the growth of a root down into the nitrogen-bearing layers below. A plant would certainly grow under such conditions; and, when the crop was harvested, its stubble and what roots it had formed in the upper six inches of the soil would contain nitrogen, and the surface soil would be enriched to just this extent at the expense of the subsoil.

It would appear, then, that such an enrichment of the surface soil is possible. But few experiments calculated to demonstrate its actual occurrence have been made. The problem is not an easy one. It is difficult to take samples of a soil which shall be truly average samples; and the percentage differences are so small that they may easily be hidden by an error in sampling. Analyses by Dehérain and by Lawes and Gilbert, however, appear to show that such a gain does take place.

Finally, the relative power of different plants to assimilate nitrogen has an important bearing on this question. Wagner has rendered it probable that leguminous plants are able to assimilate freely the comparatively insoluble nitrogen of the soil, while the cereals require their nitrogen in an easily soluble form. If this is true, one of the functions of enriching crops may be assumed to be to gather the nitrogen of the soil which is unavailable to other crops, concentrate it in its roots and stubble, and yield it up again by decay to the following crop.

On the whole, it does not seem difficult to account for the effects of enriching crops without supposing that they draw materially from the nitrogen of the air, while not excluding the possibility of their so doing. Whether our agriculture is flourishing, as Lawes and Gilbert maintain, at the expense of the accumulated nitrogen of past centuries, or whether there are processes by which free nitrogen is brought into combination again in quantities sufficient to balance the evolution of free nitrogen which we know to be continually going on, is as yet an unsettled question.

H. P. ARMSBY.

[1] *Journ. f. landw*, xxxi. 30.

## NATURAL GAS.

A LECTURE on the subject of natural gas was delivered at the Franklin institute on Saturday evening, Dec. 18 last, by Mr. Charles A. Ashburner, geologist in charge of the State geological survey. The lecturer stated that natural gas was by no means a recent discovery. Even its utilization for the purposes of the mechanic arts had been successfully attempted in China, where, by pipes of bamboo, it had been conveyed from natural wells to suitable furnaces, where, by means of terra-cotta burners, it was consumed. In the confines of Persia, in the south of France, and in our own western states, burning-springs had long been known. When Lafayette visited this country in 1821, the inn in the town of Fredonia, N. Y., was illuminated in his honor by gas procured from a neighboring well. It is, however, only within recent years that natural gas has arisen to any importance in its bearing on the mechanic arts. At present the great iron and glass works of Pittsburg and of other places are supplied with natural gas as their only fuel, and millions of cubic feet are yearly consumed in Pittsburg and similarly situated cities.

Of the origin of natural gas there seems to be no reasonable doubt. It arises from the decomposition of forms of animal or vegetable life embedded in the rocks in suitable situations. The gas is not believed to be generated continuously, but merely to be stored in porous or cavernous rocks overlaid by impervious strata. When these collections are tapped, the gas is set free, but a new supply is not being formed to take its place. The position at which the gas is found is very variable, depending upon the force of gravity and upon the position of the porous layer in which the gas is confined. The lecturer entered into an accurate description of the localities in which the gas was found, and gave the reasons why it was hopeless, from geological grounds, to look for natural gas east of the Alleghenies. The region in which the gas is found is practically embraced in that portion of Pennsylvania west of the Alle-

gheny Mountains, and extending a very short distance into Ohio, New York, and West Virginia, and it is also stated to have been found in a very limited extent in Illinois and Kansas.

The most important economic locality is that in the immediate vicinity of Pittsburg, which supplies that city with the fuel for the vast iron and glass works and for numerous private dwellings. There are 6 natural gas companies in that city, managing 107 wells, and supplying the gas through over 500 miles of pipe, of which 232 miles are situated in the city proper. The total area of pipe leading into Pittsburg is given as 1,346,608 square inches, and the total capacity of the lines is estimated at over 250,000,000 cubic feet of gas per day. The largest company is the Philadelphia natural gas company, which supplies over 400 manufactories and over 7,000 dwellings with the entire amount of fuel consumed. The composition of natural gas varies greatly, both in specimens from different wells and in those from the same well at different times. In general terms, it can be described as a mixture of hydrogen, nitrogen, and marsh-gas, with occasionally higher carbon compounds. It burns with a nearly colorless flame, and gives off no odor or deleterious matter.

In speaking of the use of natural gas for domestic purposes, Mr. Ashburner pointed out the great advantages which a gaseous fuel has over a solid one like coal, and stated his belief that the greatest of the advantages of the discovery of natural gas was that it had proven the great economy and practical utility of such fuel. A thousand cubic feet of gas was calculated to equal in heating capacity 55 pounds of coal. He stated that the use of natural gas for domestic purposes would not have been possible without the inventions of Mr. Westinghouse of Pittsburg, two of whose inventions the lecturer illustrated. One of these inventions was intended to prevent leakage from gas-pipes, and to locate leaks accurately when they occurred. The leaking gas is conveyed to the nearest lamp-post and there consumed. Another invention was a most ingenious pressure regulator, which not only regulates the pressure at which the gas is supplied to the burners, regardless of the pressure in the mains, but, in the event of the pressure in the mains dropping to zero, automatically shuts off all gas from the house; nor is it possible to turn the gas on again, without violence to the regulator, until every source of escape of gas larger than a pin-hole leak has first been corrected. A model of the regulator was exhibited. The lecture was illustrated by drawings and maps and by a small working model of a well-boring apparatus.

In answer to inquiries, the lecturer stated that the source of natural gas was certainly capable of exhaustion, but that he did not think there was any imminent danger of such a calamity. The sources of supply would certainly last many years; and he believed, that, before they would give out, a method of producing an artificial gas would be invented which would perfectly supplant the present natural gas. The cost of natural gas could not be compared with our coal-gas, for the reason that the natural gas was not sold by meter. The consumer makes a yearly contract with the company to supply him with light or fuel, or both, at certain rates. A house containing twelve rooms costs, to heat and light, from $70 to $90 a year. The use of the gas is most satisfactory; for, by means of an automatic regulator, every room of a house may be kept at a temperature not varying two degrees, regardless of the condition of the outside temperature or the pressure on the mains. Defects and troubles were met with from lack of understanding how to properly regulate the supply or the combustion.

In reply to the question as to whether he thought it wise for the city of Philadelphia to lease the gas-works for a term of years, Mr. Ashburner replied, that, as a business-man, he would say that any scheme for supplying the ordinary form of coal-gas was, at the present time, extremely uncertain as a business venture. He believed that a very short time would demonstrate that there was a method of generating a fuel gas which would totally supplant all present modes of heating, and that electricity had already solved the problem of illumination. We were in a transition stage with regard to both heating and light, and for these reasons, and from this standpoint, he would regard any movement as undesirable at this time.

## PURITY OF ICE.

THE state board of health of New York has recently published a report on the purity of ice from Onondaga Lake, the Erie canal at Syracuse, and Cazenovia Lake, being the ice-supply of Syracuse. The local board of health regarded that cut from Onondaga Lake as being detrimental to health. Into this lake discharges the creek of the same name; and into the creek is discharged the sewage of the city of Syracuse, which amounts to five millions of gallons daily. At the time the inspection of this lake was made, there was a margin of from one to four feet wide of black, putrefying organic matter along the shores. The analyses of the ice from this lake showed that it contained probably from ten to twelve per cent

of the sewage impurities dissolved in the same quantity of unfrozen water of the lake. This ice also showed the presence of bacteria in great abundance, retarded somewhat in their growth by the ice, but not destroyed by it. It is perhaps needless to say that this ice was pronounced totally unfit for any purposes where it is liable to come in contact with food or drink. The ice from the Erie canal was also condemned, while there was not sufficient evidence to warrant a condemnation of that from Cazenovia Lake. The report, valuable for what has already been mentioned, is still more so by reason of the numerous references to instances in which impure ice has been the cause of dysentery and other diseases. The earliest of these was that at Rye Beach, N.H., reported by Dr. A. H. Nichols of Boston in 1875, in which there broke out among the guests of a large hotel at that place an epidemic of gastro-enteritis, caused by impure ice from a filthy pond. Another instance of sickness caused by impure ice, referred to in the report, is that of an epidemic of dysentery which occurred in 1879 at Washington, Conn., investigated by Dr. Brown of that place and by Dr. Raymond of Brooklyn. The ice had been gathered from a pond which had been used as a wallowing-ground by the pigs. Other instances are quoted of the injurious effects of impure ice upon the public health, and sufficient evidence given to show, that, in the process of freezing, water does not purify itself. The report, taken as a whole, is a very valuable contribution to this subject, and a complete refutation of the old idea that all ice must of necessity be pure.

## *COLOR-BLINDNESS AMONG RAILWAY EMPLOYEES.*

DR. B. JOY JEFFRIES, at the last meeting of the American ophthalmological society, called attention to the total failure on the part of the Massachusetts authorities to enforce the law passed in that state in 1881, by which railroad companies are prohibited from employing persons who are color-blind, or whose sight is defective, in positions requiring them to distinguish form or color signals, unless such persons have been certified by some competent person employed and paid by the company as not disqualified for such positions by color-blindness or other defective sight. A penalty of a hundred dollars is affixed for each violation of the act. In reference to the enforcement of the law, Dr. Jeffries says that "it is practically as dead a letter as the liquor laws." Numerous cases are cited which have come under the care of the speaker in which the law has been grossly violated. In one case a brakeman who had been on a road three years had been tested as to his vision by the train-despatcher, who had asked him how many knobs there were on an adjacent telegraph-pole, telling him his vision was as good as any one on the road. Another instance of the manner in which the law is violated was that of a gateman who applied to Dr. Jeffries for a certificate for blindness contracted in the army, in order that he might obtain a pension from the government. Although this man was so blind from atrophy of the optic nerve that he groped his way into the doctor's office, yet he was on duty as a gateman at an important railroad-crossing, having a certificate from the examiner of the railroad company "that he is not disqualified by defective sight." The man himself acknowledged that he was completely blind in the sun, and could not see people at his crossing. A number of instances are given where engineers and conductors were employed by railroad companies, although they were completely color-blind. Something of the same negligence seems to exist in the licensing of pilots. One pilot who could not recognize a colored side-light held in the sun six feet before his face was examined by a marine hospital surgeon, and reported as *partially* color-blind. This enabled him to be further examined by the local inspectors, who passed him by their tests, and the man has a full license. In commenting on this case, Dr. Jeffries well asks, "How many more are there?" The matter is one of such grave importance, involving as it does the life and limb of every traveller by land and sea, that the Ophthalmological society could be of no greater benefit to their fellow-beings than in calling the attention of the authorities to these gross violations of the statute, and protesting against their continuance.

## *COMMISSIONER HADLEY'S SECOND ANNUAL REPORT.*

PROFESSOR RICHMOND M. SMITH, writing in the *Political science quarterly* a few months ago, said, in his article examining the various state labor bureaus and their methods, that "the business of collecting statistics successfully is one which requires a great deal of experience, besides knowledge and administrative ability, on the part of the chief," and for the lack of that experience he found the reports of most of the chiefs defective both in method and in results. When Professor Hadley of Yale college was appointed, two years ago, chief of the Connecticut bureau of labor statistics, it was foreseen that statistics collected by one of his ability and experience in handling

economic questions would be of unusual value. The report, which has just been laid before the Connecticut legislature, amply justifies the expectations entertained concerning it. Guided both by the judgment of the chief and a special resolution of the general assembly, the investigations undertaken by the bureau during the past year were restricted to a few topics, and then made as thorough and searching as possible.

The specific questions under consideration were weekly payment and child-labor; and Professor Hadley's report concerning them may be divided into three parts. The first is a bare summary of results, possibly intended for such legislators as lack either the time or the inclination to study the tables of statistics for themselves. The second part is made up of two essays, — on labor legislation and its enforcement, and on the credit system. The third part consists of the tables of statistics, with a brief explanation of them.

In taking up the subject of weekly payment, Professor Hadley first determined the facts as they are. He found, that, of the factory operatives in Connecticut, a little less than two-fifths are paid weekly, a little more than two-fifths monthly, and about one-fifth fortnightly. Aside from salaried persons, it is found that something more than three-sevenths of the hands are paid by the piece, the remainder by the day. The percentage of those paid by piece-work is much greater among the female than among the male operatives. No connection is found to exist between payment by the piece and weekly payments. The concerns that have not adopted a system of weekly payments offer various explanations of their action. Some make no change from their custom of monthly payments because they find no demand for any change; others believe weekly payments to be impracticable; still others believe weekly payments to be a bad thing for the operatives themselves.

Of the 70,000 hands specified in the report, 20,000 are women, and about 3,000 are children. The number of children really employed, Professor Hadley believes to be greater than shown by the figures. With the children, monthly payment is most frequent. It is an interesting fact, too, that the larger the factory, the greater is the percentage of women employed. The number of children reported, on the other hand, is greatest in mills employing between one hundred and two hundred hands. The employment of women reaches the largest proportions in the manufacture of wearing-apparel; that of children, in textile industry, where the percentage averages about nine. The children are principally occupied in tending machinery. The returns as to the wages of these children show a scale of wages running from about a dollar a day (paid to hands over eighteen years of age) to thirty-five cents a day (paid to the youngest hands).

Of 65,627 hands, about five per cent are employed 54 hours or less per week, twenty-two per cent from 54 to 59 hours, over fifty-six per cent from 59½ to 60 hours, while sixteen per cent have an average working-day of more than 10 hours. The longer hours prevail generally in the textile industries, though barbers reported the longest hours of all, — 92 hours weekly. The cigar-makers, the only trade in which the eight-hour system was carried into effect, show a decided reduction in this respect. In concluding this portion of his report, Professor Hadley says: —

"We thus reach the conclusion that monthly payments, long hours, and child-labor go hand in hand. This fact is in one sense precisely what might have been expected; yet the results are so noticeable that they will bear repeating. First, practically none of the weekly payment mills have a normal working-day of over ten hours. Second, leaving out cases of fortnightly or mixed payment, a minority of men, a majority of women, and a two-thirds majority of children, are paid monthly. Third, less than one-eighth of the men, but more than one-fifth of the women, and more than one-third of the children, are employed regularly over ten hours a day. Fourth, the counties and industries which show the largest proportion of weekly payment, show the smallest proportions of women and children employed, and *vice versa*."

Now, these three things, — child-labor, long hours, monthly payments, — when found co-existing, indicate a society on a low industrial level. Any one of them may be, in exceptional cases, necessary; but the three in conjunction indicate an evil which the state is justified in attempting to remedy by legislation. The discussion which follows as to the practical difficulties of labor legislation and the proper attitudes of labor organizations toward the law, is in every way commendable, and we regret that lack of space forbids our reproducing the most important portions of it. One or two extracts must suffice.

"To make a law worth any thing at all, somebody must be willing to incur the hardship and odium, and, if need be, actual danger, in order that its provisions may be carried out. If a body of workmen demand legislation, and then, either through apathy or timidity, are not prepared to support the officer of the law in its execution, they are simply encouraging sham legislation. It is perfectly easy for a legislator to vote for a law which will satisfy the demands of extremists

not accomplish its objects. The more extreme character of the measure, the surer it is of nforcement."

f organized labor takes a fair legal chance rosecuting the grievances of individuals, it y gives those individuals a fair chance be- the law; if organized labor does not prose- such grievances, it gives the employers an nity from interference at present, but at the f almost revolutionary consequences in the e.

There is nothing to prevent the knights of , or a trades-union, from being incorporated r the law of the state of Connecticut at nt. Though not generally understood, this act."

uch legislation may help in raising the ard of the community. But let it be clearly rstood that it is a rough process, and not a th one; that it frequently bears hardest e we should wish to see it bear least; and it is hopeless to attempt to enforce it, until whom it is designed to benefit — or, at a large part of them — have risen high gh to reap the benefit, and are sufficiently nced of those benefits to use their own per- efforts for its enforcement."

e last portion of the report which we can ion is that which deals with the credit sys- Professor Hadley discusses in order the icability and the desirability of weekly pay- s and the best means of securing their en- ment. To most of his argument we give hearty assent, though we think even more ht should be given to the objections to week- yments advanced by certain manufacturers, submit, that, from the very character of their , its product cannot be properly estimated paid for every week. We are glad, too, to hat Professor Hadley appreciates the fact for the best employees weekly payments d be useless, and for the worst they would orse than useless. The average workman is one to be benefited by them. The report marizes this discussion thus: —

°. The system of cash payment is a real ad- ge to the workman. 2°. The difficulties of ly payment are not so great as is commonly sed. 3°. But there nevertheless remain a ient number of cases to which a weekly ent law could not well be applied, to itute a serious reason against making the n compulsory. 4°. The same general result be reached more surely from another direc- by abolishing the factorizing process. This l necessitate a system of cash payments as a and the exceptions to it would regulate themselves in such a manner as to involve less difficulty. 5°. We therefore recommend that the legislature pass a law exempting the wages of all mechanics, journeymen, or laborers, from attachment for debt; with such additional legislation as may be necessary to prevent its effects from being evaded by the systematic assignment of wages on usurious terms."

With reports such as this of Commissioner Hadley, and those of Carroll D. Wright of the national and Massachusetts bureaus, before us, we can conscientiously commend the sagacity of Dr. Engel, one of the most eminent statisticians in Germany, and late chief of the Royal statistical bureau of Prussia, when he said that his ambition would be satisfied if he could accomplish in Germany the same work that was being done by some of the American statistical bureaus.

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## *SEDGWICK AND WILSON'S BIOLOGY.*

THE old and thoroughly vicious notion that "the power of repeating a classification of animals with appropriate definitions has any thing to do with genuine knowledge," is slowly disappearing before the advance of a rational method of teaching biology; namely, that of bringing the student face to face with the objects of his study. Much of this reform is due to Huxley and Martin's 'Elementary biology,' which appeared some ten years ago. In the book before us two of Professor Martin's former pupils undertake to elaborate and improve his plan of instruction, intending it to serve as a factor in general education or as "a basis for future studies in general biology, botany, zoölogy, or medicine."

After a general introduction, and chapters on the composition of living organisms, on protoplasm (which contains several pages on organic chemistry), and on the cell, then follow the long and very careful accounts of the bracken-fern and earth-worm, the typical examples selected of vegetable and animal life. The anatomical, physiological, and embryological aspects of the subject are (for an elementary work) treated with unusual fulness of detail. The authors have done wisely in not following Huxley and Martin's order of treatment, which begins with the unicellular organisms. This is the logical order, but it is beset with practical difficulties. As a matter of fact, most teachers will agree that beginners take most interest in, and succeed best with, forms which they are accustomed to see around them. The structure and functions of microscopic forms are really much more difficult for the beginner to

*General biology.* By WILLIAM T. SEDGWICK and EDMUND B. WILSON. Part I.: Introductory. New York, *Holt*, 1886. 8°

grasp than those of the higher animals and plants. On the other hand, if too differentiated types be selected, the mass of detail becomes somewhat embarrassing. One may doubt, however, whether the earth-worm is the best selection that might be made, on account of its small size and the rather skilful dissecting it requires. To those who do not accept the annelid origin of the vertebrates, its supposed central position and clear relation to the animals above it are not so apparent.

A novel and most valuable feature of this book is the attention devoted to physiology and embryology. This method of treatment will no doubt prove most attractive and stimulating to the student, as well as give him a much more just and adequate conception of the subject than is possible from anatomical methods alone.

As a whole, the work is excellently done, and the points to which one may wish to take exception are of minor importance. There is not quite enough distinction between fact and inference. For instance: while few naturalists reject the theory of evolution, it seems hardly in place in an elementary text-book. Huxley's example, in respect to matters of theory, is a good one. Then, too, the amount of physics and chemistry is somewhat unnecessary: if the student knows the elements of these sciences, it is superfluous; if not, it is insufficient. But these slight criticisms notwithstanding, we can sincerely congratulate the authors upon their work, and cordially commend it as a very valuable aid to teachers.

The publisher's share of the book is excellent as to print and paper, but the execution of the illustrations is not all that could be wished. Unfortunately this is a complaint that must very frequently be made of American scientific books.

### *ABBOTT'S UPLAND AND MEADOW.*

THE author of 'Upland and meadow,' Dr. C. C. Abbott, tells us the secret of his success on the very first page. To him every half-acre is an inexhaustible zoölogical garden, every creature is companionable, amusing or instructive or both, and thus no ramble can be lonely, nor even the shortest walk through the tamest region uninteresting or uninstructive. But, like many other secrets, this is of little use to any except those fortunately to the manner born.

The relation between the author and his (generally feathered or furry) friends is not merely one of companionship, but of good-fellowship, comradeship. There is a sympathy between them. He continually tries to put himself in feeling in their place, not only by his kindness, but by the practical jokes which he plays upon them (see pp. 76–79 and 209) and his keen enjoyment when they use the opportunity to laugh at him. The questions which he answers, and the experiments which he tries, are those which would occur to no mere anatomist or pure systematist, but only to one to whom all nature is in a certain sense akin, and who desires an *inside* view of it. And this, combined with a keen sense of the humorous and a command of a simple style and plain English, constitutes the great charm of the book.

We cannot but feel, however, that what he sees in the birds is often a reflection of his own keen humor; that he often transfers to their minds trains of thought which really exist only in his own; and that, while his observation may be entirely correct, his inferences from them are those of a warm friend rather than of an impartial judge. But one is disposed to pardon the author for this, especially while reading his pages.

The book is throughout a study of animal life, not of dead animals. It is a plea for the study of life-histories, of the habits, instincts, feelings, and thoughts of the common animals. It is a book which would encourage boys to observe, and give the young naturalist an introduction to a field for work unfortunately too sadly neglected by the present generation of scientific men. Why should not every one have a 'Poaetquissings Creek'? Every one knows of similar streams, with their uplands and meadows teeming with a life of which we know practically nothing. It is hard to see how any one can read the bright and attractive pages of this book without making a firm resolve to observe more widely and carefully than he ever has before; and a book which will make boys and girls, and men and women, more observing is certainly doing the very best educational work. If love to being in general is the essence of virtue, we shall all certainly be the better for reading it. But the scientific man will also find in it much useful information, and many valuable observations of the occurrence and habits of some of our less known and studied animals.

*Upland and meadow: a Poaetquissings chronicle.* By CHARLES C. ABBOTT, M.D. New York, *Harper*, 1886. 12°.

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ACCORDING to the *Lancet*, a new anaesthetic has been discovered in Australia. It is called drumine, and is obtained from the Euphorbia Drummondii. It is local in its action, and has certain advantages over cocaine, which is now so extensively employed for local anaesthesia. Its effects are as yet not sufficiently understood to warrant the acceptation of all that is claimed for it; but it will doubtless be investigated further, and its efficacy and value be more thoroughly established.

# SCIENCE.

FRIDAY, JANUARY 21, 1887.

## COMMENT AND CRITICISM.

THE AMERICAN LIBRARY ASSOCIATION is not satisfied with the present apportionment of the public documents. A special committee, headed by Librarian Samuel S. Green of Worcester, Mass., has addressed a communication to the senate committee on printing, enclosing the draught of a resolution, which, if favorably acted upon, will satisfy their wants. The resolution provides that "the public printer shall deliver to the Interior department a sufficient number of copies of the *Congressional record* (bound), 'statutes-at-large,' and of every other government publication, not already supplied for this purpose, printed at the government printing-office, including the publications of all bureaus and offices of the government, excepting bills, resolutions, documents printed for the special use of committees of congress, and circulars designed not for communicating information to the public, but for use within the several executive departments and offices of the government, to enable said department to supply a copy to every depository of public documents designated according to law." The association also believes it would be well if copies of some of the public documents of greatest interest could be sent to such public libraries, not depositories, as have more than a minimum number of volumes, — say, 5,000 or 10,000. It is urged that the expense need not be large, for fewer than five hundred copies would be needed, and there would be no charge for composition, but only for paper, binding, and presswork. There is a great deal of force in this suggestion, and we should be glad to see it receive legislative sanction. Every year our public documents become more valuable, and a larger number of them are of general importance. The reading public should have free access to these volumes at convenient centres of population, and the plan of the library association would accomplish this.

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A GREAT MASS of detail of much interest to the students of university organization and work is contained in a recent parliamentary return concerning the universities of Oxford and Cambridge. It is of most general interest to know what salaries celebrated professors receive, how much lecturing they are required to do, and how many hearers they have. On all of these heads the return is very full and explicit. At Oxford Canon Driver, regius professor of Hebrew, gave in 1885 a hundred and five lectures to classes of from fifty to sixty students. His salary is £1,500. Professor Bryce of the chair of civil law delivered twenty ordinary and two public lectures. No record was kept of the attendance. Professor Bryce's salary is £435. Professor Sylvester, Savilian professor of geometry, gave forty lectures to fourteen students. His salary is £700. Prof. E. B. Tylor, the anthropologist, receives £200, and lectures eighteen times to about twenty-five hearers. Prof. Benjamin Jowett, the Hellenist, receives £500 per annum, and did not lecture in 1885, as he was vice-chancellor of the university. Prof. A. H. Sayce had only from three to sixteen hearers for his lectures on comparative philology. He receives £300. The professor of moral philosophy, William Wallace, receives £400 a year, and has from forty-eight to seventy students at his twenty-eight lectures. Professor Freeman keeps no record of the number of his hearers. His salary is £700, and he gives forty-two lectures during the academic year.

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At Cambridge things are not very much different, but we may cite a few examples for the sake of comparison. Canon Westcott, professor of divinity, has a salary of about £800. He gave in 1885 sixty-six lectures, and his audience varied from ten to three hundred and fifty. Professor Stokes, of the chair of mathematics, receives £470, and delivers forty lectures to about eight students. The Knightsbridge professor of moral philosophy, Henry Sidgwick, has £700, and delivered eighty-seven lectures to from four to twenty hearers. Professor Darwin, of the chair of experimental philosophy, gave forty lectures, and had eighteen students. His salary is £580. The professor of modern history, J. R. Seeley, has an income of £371, and gave one lecture a week for two terms, averaging ninety hearers. He had, in addition, sixty ladies who were preparing for the university

closed, when it was announced that Dr. Waldstein, who delivered a lecture a fortnight ago on scientific methods in archeology, was to give a course next March; and now Prof. A. L. Frothingham, recently of Johns Hopkins and now of Princeton, is delivering a series of five lectures on Assyrian archeology. While so much activity has thus been shown in the different fields of classical archeology, prehistoric archeology has been more fully recognized in the appointment last week of Mr. F. W. Putnam, the curator of the Peabody museum, well known for his careful researches in American mounds and other remains, to the Peabody professorship of American archeology and ethnology.

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PROFESSOR CALDERWOOD'S short paper in the *New Princeton review*, on the present status of philosophy in Britain, is exceedingly clear and satisfactory. And, coming from a man who has taken so active a part in the philosophical controversies of the last quarter of a century, it is rather surprisingly judicial in tone. Professor Calderwood starts with Hume, and briefly shows the course the reaction against him has taken in Great Britain, France, and Germany. He outlines the rise of the experiential philosophy in Great Britain, and indicates its present points of weakness. He also shows why Kant and Hegel have found so large a following among English students of philosophy, but claims that in Great Britain, as in Germany, Hegelianism has lost its grip, and that there is a marked return to Kant for the purposes of further exposition and criticism. The outlook for the future, Professor Calderwood views optimistically. We are to be tied down neither to bare experientialism nor to unintelligible rationalism. The British philosophy is to draw what is best and truest from both schools in the formulation of a philosophy of certainty. "The thought of the nation is in a transition stage, preparing for a new advance; and, when this comes, it promises to be the fruit of all that is best in German and British thought, and in its nature a further clear advance toward a philosophy of human knowledge, — a philosophy of certainty."

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IN HIS ANNUAL REPORT to the New York state legislature, Superintendent Draper states that between three and four thousand public-school teachers drop out every year, and that the large majority of the vacancies thus created are filled by the appointment of persons without any experience in teaching or training for it, and very many of whom have no intention of teaching permanently. This is a great evil, and, as things are at present, cannot be adequately corrected, though mitigation seems possible. The proper remedy would be to hold in reserve a certain number of persons of normal-school training, who could be at once appointed to such vacancies as they might occur. The objection to this plan would be the expense attendant upon it, and the uncertainty as to just how many vacancies would occur annually. The expense would be something, to be sure; but it would be the cheapest way of saving thousands of school-children of tender age from the disturbing influence of 'quack' teachers. And a table of statistics kept for a few years would give an average annual number of vacancies that would be sufficiently accurate for all practical purposes. Even at some expense and trouble, this evil of foisting unfit and untrained teachers upon the schools should be speedily done away with.

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ONE CHAPTER in Professor Payne's 'Contributions to the science of education,' which we notice in another column, has excited a great deal of angry criticism in some of the school-journals. That chapter is the one in which Professor Payne pays his compliments to the maxim, 'Proceed from the known to the unknown,' and denominates it a piece of educational cant which is accepted because it saves the trouble of thinking. Some of Professor Payne's critics have been firm but mild, while others have worked themselves into a great state of excitement, and have saluted his chapter as a voice from mediaeval darkness, and classed him as a pedagogical and psychological ignoramus. We are disposed to think that Professor Payne is partially right, but, on the whole, wrong. His contention that definitude is a late and not an early step in the elaboration of knowledge is well founded, but it does not logically follow that on that account progress is from the unknown to the known. If it were so, we should have no starting-point. The process of acquiring knowledge would be the addition of an indefinite number of zeros. Instruction must arouse some answering chord in the pupil's mind, and, so far at least, the subject of the instruction must be known, and not unknown. But that this fact will not bear all the interpretations so often put upon it, is also true. In any event, Professor

Payne need not be personally denounced for holding an opinion at variance with that of some other educators.

MESSRS. GURNEY AND MYERS have replied, in the January issue of the *Journal of the Society for psychical research*, to the criticisms made upon the literary committee, of which they are the executive officers, by certain members of the society. These criticisms were based upon the fact that the literary committee had not officially examined certain evidence for the so-called 'physical phenomena' of spiritualism. In reply, the secretaries state that they had to begin somewhere, and that two good reasons existed for selecting, as the first subject for consideration, the phenomena known as cases of 'spontaneous telepathy,' the discussion of which is so large a part of their lately published book, 'Phantasms of the living.' The first reason was that these phenomena seemed to connect themselves in a natural way with the results of experimental thought-transferrence, the investigation of which had been undertaken even before the formation of the society. The second reason was that a very large proportion of the answers received by the committee in response to their public appeal for evidence of psychical phenomena dealt with cases of spontaneous telepathy. So, that this subject should come first in the work of the committee was perfectly natural.

The secretaries further urge that it is not to be forgotten that the evidence in the cases of 'physical phenomena' of spiritualism is distinguished from the evidence in the case of spontaneous telepathy, automatic writing, mesmerism, and so forth, by some radical differences. In the first place, the alleged phenomena have been, for the most part, observed in the presence of professional mediums, persons having a pecuniary interest in their production. The evidence has no longer to do with the validity of perceptions, but with the validity of inferences, with the correctness of the interpretation of subjective impressions. Furthermore, this evidence differs in form from that in the other topics dealt with by the committee. It does not consist of records sent in manuscript to the committee, and previously known but to a few persons; but most of it has already been published in periodicals and in books. Much of the evidence, too, is offered by persons of no training in the kind of observation required, and of no special aptitude in the arrangement of tests. On all of these grounds the literary committee feels that the sifting and criticism of this evidence is a task beyond their normal functions, and state that a special committee is forming to which all such evidence is to be referred for investigation and report.

WE ARE THOROUGHLY PLEASED to learn, that, at the recent meeting of the Massachusetts state teachers' association, the peddling of text-books and school-journals was prohibited. The ambitious agents of school publishers and journalists have infested state and county association meetings so often in the past, that they thought themselves perfectly secure in the enjoyment of their privileges. But some firm hand has put a stop to the practice in Massachusetts, and we trust the example will be generally followed. Legitimate advertising is commendable, and an agent is to be praised rather than blamed for his assiduity. But the publishers of text-books and school-journals have carried the thing so far that they interfere largely with the regular work of a teachers' association meeting. It is not the use of the privilege, but its abuse, that we decry; and we want to see plenty of imitators of the independent stand taken in Massachusetts.

## THE AIMS OF GEOGRAPHICAL EDUCATION.

Mention all the names of places in the world derived from Julius Caesar or Augustus Caesar.

Where are the following rivers: Pisuerga, Sakaria, Guadalete, Jalon, Mulde?

All you know of the following: Machacha, Pilmo, Schebulos, Crivoscia, Basecs, Mancikert, Taxhen, Citeaux, Meloria, Zutphen.

The highest peaks of the Karakorum range.

The number of universities in Prussia.

Why are the tops of mountains continually covered with snow (*sic*)?

Name the length and breadth of the streams of lava which issued from the Skaptar Jokul in the eruption of 1783.

THE above table, taken from Professor Ravenstein's lecture before the Royal geographical society,[1] is very probably a combination of the more atrocious questions on several examination-papers. It none the less will serve as a text for our paper; and this because it fairly represents the ideas of certain so-called 'teachers of geography' as to the limits of the science they were attempting to teach. To them geography simply meant the cramming into a child's mind so many isolated facts, so many heights of mountains, so many lengths of rivers, so many names of places,

[1] *Royal geographical society, report of the proceedings of the society in reference to the improvement of geographical education.* London, *Murray*, 1886.

most of them of no possible importance to the student. Indeed, so far and wide has this erroneous idea of geography spread, that there are books actually made for the purpose of teaching this sort of thing. For instance: there is a compiler who has been known to assert, and to assert with pride, that, by the use of his book, one might learn the names of seventeen thousand places in the course of a few years. Just as though there were any object in one's turning one's self into a walking gazetteer, when gazetteers in plenty could be found on the shelves of a neighboring library! In fact, one is irresistibly reminded of the paragraph in the introduction to Mrs. Green's 'Short geography of the British Islands,' the introduction being the work of the brilliant writer, though inaccurate historian, the lamented J. R. Green. He says: —

"No drearier task can be set for the worst of criminals than that of studying a set of geographical text-books, such as the children in our schools are doomed to do. Pages of 'tables,' — 'tables' of heights and 'tables' of areas, 'tables' of mountains and 'tables' of tablelands, 'tables' of numerals, which look like arithmetical problems, but are really statements of population, — these, arranged in an alphabetical order or disorder, form the only breaks in the chaotic mass of what are amusingly styled 'geographical facts,' but which turn out to be simply names, — names of rivers and names of hills, names of countries and names of towns, — a mass rarely brought into grammatical shape by the needful verbs and substantives, and dotted over with isolated phrases about mining here and cotton-spinning there, which pass for industrial geography. Books such as these, if books they must be called, are simply appeals to the memory: they are handbooks of mnemonics, but they are in no sense handbooks of geography."

This, of course, applies more particularly to British geographical text-books. But, so far as the present writer can see, the same remarks are applicable to many of our most popular (with the teachers) text-books. That this is so, is no reflection on the teachers: it is the fault of their early education. And for this our college and normal school authorities are more especially responsible. The evidence that improvement in such respects must come from the university downwards seems to be irresistible. Nor should the publishers be blamed. If they could see the evidence of the demand for better school-books, — books that were not miniature gazetteers, — they would undoubtedly supply it. I remember only a year ago taking a set of the best and most popular school-maps made in Germany to a well-known and enterprising publisher of text-books. I suggested that perhaps some arrangement could be made with the German publisher by which the maps could be adapted to the use of English-speaking scholars. The gentleman very frankly replied that he could not sell a set of the maps, even if the names were in English. He added, that our people wanted maps colored differently; that is, so as to obscure the physical features. A short time afterwards the same publisher brought out a set of maps of the United States with little angles marked on them so that the scholars could draw the state lines with accuracy, as though that was the end of geographical education. But it was not his fault. His business was to supply the demand, not to get out good maps.

If the learning of seventeen thousand names 'in a few years,' or the 'bounding' of countless states, or the making of maps that will look well on exhibition, is not the end of geographical teaching, what is the use of teaching it at all? What is the aim of geographical education?

In the first place, geography, properly studied, gives one a clear and accurate knowledge of the physical conformation of the earth's surface. This is physical geography, and should be studied first. But this is not the mere learning of 'tables of heights,' etc. It is something entirely different. One may have a very good knowledge of the formation of the earth, and yet be densely ignorant of the height of the Karakorum range. And, as a general rule, the less of such stuff crammed into a child's head, the more physical geography he will know. He should rather be taught to observe phenomena. It is true that such knowledge is hard to get at on examination; but that is not so much the fault of the knowledge as of the examination. Then the flora and fauna of each region of the earth's surface should be properly associated in a child's mind. In this connection, it may be said that nothing is less calculated to convey this knowledge than the ideal or 'model landscapes' too often to be found in our schoolrooms. Geography aims also to teach the influence of geographic factors upon the development of the human race. This influence is frequently exaggerated. But the working-out of such problems, even on insufficient data, must have a stimulating effect upon the mind. It may be said that the teaching of the distribution of the flora belongs rather to botany. So undoubtedly any detailed study of the various floras does belong to botany. But a knowledge sufficient to enable one to assign to any given region its appropriate plant-life, and to trace the influence of that floral environment on man, is surely within the domain of geography.

As one of the most important aims of the real teacher of history is to instruct his pupils in the use and making of historical works, so in geography one of the most important things is the teaching of the use and construction of maps. And it may be said, that to the student of history or of geography, to the traveller or military commander, the ability to read a map is next in importance to the ability to read a book. And it is something not easily acquired. It may be said that there can be no difficulty in distinguishing a river from a mountain. And very likely there is none; but such knowledge is no more map-reading than the distinguishing $a$ from $x$ is book-reading. Nor is map-making cartography. To some minds the two seem inseparable; and the student is required to draw a map with the nicety of a practised cartographer, under the pretence that he is learning geography. He is doing nothing of the kind. The ability to go out of doors and make a good working sketch of the surroundings of one's own school-house is of more value, geographically speaking, than the ability to construct, from sketches and details of survey, a map of Cape Cod with all the accuracy of a Swiss cartographer. No one confounds the art of writing and that of printing. Then why should he confound the describing geographical features with geographical symbols and reproducing the same with the greatest accuracy for permanent use? Geography is not cartography, nor is it topography, although both these elements combine in geography. Properly taught, map-drawing is the best guide to map-reading.

To sum up the aims of geographical education, or perhaps I should say its only aim, is to make men understand what is going on around them,— to converse intelligently upon the present crisis in Bulgaria, or the economic changes which will be wrought by the Panama canal, if it is ever opened; to travel abroad with some degree of satisfaction to one's self, and to one's readers if one writes a book; to read with interest and appreciation articles on campaigns, like those now appearing in the *Century*. For what information can a map, accurately drawn with contour-lines or hachures, convey to a man who does not know what those symbols mean? And, finally, the student of modern history who is not familiar with the geographical features of western Europe can gain only a very dim idea of what the everlasting changes of boundary really mean. The marked difference between the books now being produced by French, English, and American travellers, on the one hand, and German explorers, on the other, is too great to escape attention. That difference is due entirely to the fact that in school and university the German is taught, in the first place, to see, and, in the second place, to understand what he does see. This power (for such knowledge is power) is fast pushing the German to the foremost place in war, in commerce, and in exploration. If he could also be taught to relate in clear and simple language what he thus has learned, it would be a positive gain to mankind.

EDWARD CHANNING.

## *AMERICAN SOCIETY FOR PSYCHICAL RESEARCH.*

THE society held its annual meeting at the rooms of the Boston society of natural history on Jan. 11. The auditorium was crowded, it having been announced that there would be shown some 'apparent thought-transferrence' and some muscle-reading.

The thought-transferrence was performed by Dr. Minot, with the assistance of Mr. C. B. Cory, and was designed to show the character of the dangers arising from fraud introduced into experiments on mind-reading, similar to some of the experiments made by the committees of the English society for psychical research. The audience were at first not informed of the ultimate purpose of the experiments, and were for the most part entirely deceived, although many were suspicious. Several persons took a card, and, having fastened their attention upon the card, they approached Dr. Minot, who proceeded to draw it upon the blackboard without having seen the card. There were two failures, one of which was partial only, and two successes. Later in the evening Dr. Minot explained that the experiments were fraudulent, and had depended upon Mr. Cory's skill in card-forcing, so that the persons had not really chosen their cards, but had taken them from Mr. Cory. It had been arranged in what order the cards should be given, so that every one was known to the *mind-reader*, and his failure-drawings were intentional blinds. The signals used to indicate what person was coming were also described. Dr. Minot then added a few words, which made clear the lesson intended; namely, that in many of the English experiments, which offer the only evidence worth heeding, of thought-transferrence, there existed evident opportunities for fraud, and that therefore the experiments in question are inconclusive. He expressed his unwillingness to believe in thought-transferrence in consequence of the evidence yet presented, and his hope that the amusing demonstration made by Mr. Cory and himself would serve the serious and grateful purpose of emphasizing the dangers of credulity in these matters.

Entirely straightforward were the very admirable performances in muscle-reading by Mr. Charles H. Montague, a gentleman who, in the course of a few weeks' practice, has acquired an extreme skill. He first repeated a mock murder, similar to the repetition recently achieved by Bishop and noticed in our columns (*Science*, viii. p. 506). He then accomplished another feat, that of reconstituting a tableau, which had been arranged by Prof. W. T. Sedgwick while Mr. Montague was out of the room. When he returned, he took hold of Professor Sedgwick's hand, and quickly found the persons and objects, and placed them in the proper positions quite exactly. All of this was done by muscle-reading; and, in reply to a question from one of the audience, Mr. Montague said that mind-reading had nothing to do with his obtaining the requisite information from the subject.

The various committees made brief reports of progress, that of the committee on apparitions being the most interesting, several remarkable cases being read by Professor Royce, who closed his suggestive remarks by stating that the committee was desirous of accumulating a much more extensive material.

The chairman, Dr. Bowditch, called attention to the fact that the society, in order to employ a qualified secretary and meet the expenses of its work, requires at least two thousand dollars, about half of which has already been raised. Under these circumstances, the council had regarded it as safe to engage the service of Mr. Hodgson, who had agreed to come. Mr. Hodgson is well known by his thorough exposure of the Indian theosophical society and the frauds of Madame Blavatsky. The society has hitherto been at a disadvantage, because its leading members have been so pressed by professional duties that they have been able to give very little time to the active work of the committees. But, if the funds which the society asks for are secured, it will be enabled to prosecute its various researches into psychic phenomena with activity as well as zeal.

An appeal to all those interested in the objects of the society to help contribute to the balance of the required sum has been issued by the council, Henry P. Bowditch, Charles B. Cory, George S. Fullerton, Edward G. Gardiner, E. H. Hall, G. Stanley Hall, Charles C. Jackson, Joseph Jastrow, William James, Charles S. Minot, Simon Newcomb, E. C. Pickering, W. H. Pickering, James M. Peirce, Josiah Royce, Minot J. Savage, Samuel H. Scudder, Coleman Sellers, R. Pearsall Smith, William Watson. Subscriptions should be sent to C. C. Jackson, 24 Congress Street, Boston.

We trust that the society will expand its scope, and turn to the solution of some of those problems of psychology which press on every side for solution. We are therefore glad to learn that a committee on experimental psychology has been appointed.

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## GOVERNMENT SCIENTIFIC WORK.

THE work upon the report of the Charleston earthquake, to be made by Captain Dutton of the U. S. geological survey, is progressing rapidly. The data collected are very voluminous, and of a character which is quite as satisfactory as could reasonably be expected. The number of separate reports, amounting to about twenty-five hundred, have been card-catalogued, and the plotting for isoseismals has begun. The data are less satisfactory than could be wished, although a few reports of the time of the passage of the earthquake shock in various parts of the country will be sufficiently accurate to determine the velocity of propagation of the earth-wave, and with a much smaller probability of error than in any other earthquakes previously reported. The final computations have not as yet been made, but sufficient is known to indicate with certainty a velocity somewhat in excess of three miles per second. The data relating to the epicentral localities and their immediate neighborhood are quite full, and it is expected they will prove instructive and suggestive. Captain Dutton is reluctant to speak very decisively about the final results, believing that any very specific statements would, for the present, be premature.

Prof. Raphael Pumpelly, chief of the division of archean geology, who has been on the temporary roll of the U. S. geological survey, has been placed on the permanent roll, in consequence of the resignation of Mr. F. V. Hayden.

The question of successorship to General Hazen is being discussed. Captain Greely is most likely to succeed to the position of chief signal officer. He will at least remain at the head of the service temporarily, until arrangements are perfected for separating the weather-bureau from military control, and establishing it permanently under a civil branch of the government. General Hazen was quite opposed to any such transfer, but changed his mind about six months ago. This leaves the matter now open ; and, as no officer of high rank would be affected by the change, it will probably be made. None of the officers of the service would offer any opposition to the movement.

Another important step has been taken in the permanent exposition project in Washington, the select committee of the senate having reported in

favor of commemorating the centennial of the constitution at Washington in 1889. The committee has not reported upon the manner of the proposed celebration, and also in regard to the quadri-centennial of 1892; but the action now taken furnishes sufficient assurance that the entire programme as contemplated by the board of promotion, and including its exposition features, will receive the indorsement of congress.

The department of agriculture estimates of area, product, and value, of corn, wheat, and oats for permanent record, are completed. The corn-crop, in round numbers, aggregates 1,665,000,000 bushels, grown on 75,000,000 acres of land, and has a farm value of $610,000,000. The yield is 22 bushels to the acre, or 4½ bushels less than last year. There is an increase of area of over 3 per cent, and a decrease in product of 14 per cent; while the average price has increased 12 per cent, or from 32.8 to 36.6 cents per bushel. The aggregate product of wheat is 457,000,000 bushels from an area of nearly 37,000,000 acres, having a farm value of $314,000,000. The average value is 68.7 cents per bushel, against 77.1 for the previous crop, and 64.5 cents for the great crop of 1884. This is 35 per cent reduction from the average value between 1870 and 1880. The product of oats is 624,000,000 bushels, 5,000,000 less than last year, from an average of over 23,000,000 acres, producing a value of $186,000,000. The average yield is 26.4 bushels against 27.6 last year. The average value is 29.8 cents per bushel; last year, 28.5 cents.

An effort is being made in Washington to secure the hall of the house of representatives for the opening session of the ninth triennial meeting of the International medical congress on the 5th of next September. About two thousand delegates are expected, including some three hundred from Europe. After the opening meeting the congress will be divided into seventeen sections, meeting in the different halls of the city.

An invitation has been received at the department of state, asking the government to appoint a delegate or delegates to the Fourth international prison congress, to meet at St. Petersburg in the year 1890. The President transmitted a message to congress on this subject last week, favoring the appointment of delegates, and they will probably soon be named.

The following bulletins of the U. S. geological survey are now in the hands of the printer: 'Physical properties of iron carburets,' Barus and Strouhal; 'Subsidence of small particles of insoluble solids in liquid,' Barus; 'Types of Laramie flora,' L. F. Ward; 'Peridotite of Elliott county, Ky.,' J. S. Diller; 'The upper benches and deltas of the glacial Lake Agassiz,' Warren Upham; 'Fossil faunas upper Devonian Genesee section,' H. S. Williams; 'Report of work done in chemical division U. S. geological survey during fiscal year 1885–86,' F. W. Clarke; 'On the tertiary and cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama rivers,' E. A. Smith and L. C. Johnson; 'Historical sketches of general work in Texas,' R. C. Hill; 'Nature and origin of phosphates of lime,' R. A. F. Penrose, jun.; 'Bibliography of American Crustacea,' A. W. Vogdes.

## NOTES AND NEWS.

THE literature of spiritualism has recently been increased by an historical sketch of the subject by Dr. Paul Gibier ('Le spiritisme,' etc., Paris, 1887). The author is not a spiritualist, and takes great pains to state his disbelief in the supernatural in big letters. As a further guaranty of the scientific spirit which prompts his inquiry, he appends a list of his contributions to medical science. For the most part, Dr. Gibier contents himself with the *rôle* of historian. He gives a rapid sketch of the spiritual theories from the ancient Hindoos down to the researches of Crookes and Zöllner. His account of the modern developments in this strange field is quite convenient and readable. An outsider would hardly credit the statement that in Paris (by no means a stronghold of spiritualism) there are not less than 100,000 spiritualists. The statistics of the periodical literature of spiritualism is also astonishing: 13 such periodicals are in French, 27 in English, 36 in Spanish, 5 in German, 3 in Portuguese, 1 in Russian, 2 in Italian. Besides, a Franco-Spanish journal is published at Buenos Ayres, and a Franco-Dutch at Ostend. While the main portion of the work is historical, a few chapters are devoted to the account of séances mainly with the famous slate-writing medium, Slade. These have convinced the author that there are genuine facts in these phenomena which spiritualistic hypothesis, as well as current scientific knowledge, is unable to explain. More research is necessary before the final verdict can be given, and it is cowardly for science to refuse to study all such facts, and seek their explanation.

—The Indiana state teachers' association began its annual meeting in Indianapolis Dec. 28, extending its sessions through the two succeeding days. The high school section, and country and village school section, held the sessions on the 28th, and on the other days the association held meetings as a whole. A number of papers were presented in

general session, each supposed to be applicable to the needs of the common schools of Indiana. The following papers were read before the high school section: 'Mathematics as a factor in mind-development,' by J. A. Camagey; 'Limitations in pedagogical psychology,' by J. R. Hart; 'Psychology in its relation to English literature,' by A. M. Huycke; 'Some observations on teaching Latin in the high school,' by George W. Hafford; and 'Zoölogy in the high school,' by Prof. O. P. Jenkins.

— The *Medical news* contains an interesting statement of the books, pamphlets, etc., in the principal medical libraries of the country. It is as follows: —

| | Volumes. | Pamphlets. |
|---|---|---|
| Library of surgeon-general's office......... | 76,700 | 106,600 |
| Library of College of physicians of Phila... | 34,234 | 16,026 |
| Library of New York academy of medicine. | 20,000 | 12,000 |
| Boston medical library........................ | 16,374 | 13,364 |
| Library of the New York hospital.......... | 15,800 | — |
| Library of the Pennsylvania hospital...... | 15,000 | — |

— The Bell and Lancaster systems of education, or at least so much of them as relates to the employment of monitors or pupil teachers, have been considered dead. But the London *Journal of education* announces that the Bradford (England) school board has adopted a plan according to which pupil teachers are retained, but on the half-time system, and they are placed during the second half of the time in a central class for instruction under skilled teachers. If pupil teachers are to be retained at all, some such basis as this is the only one on which it should be done.

— Prof. John W. Burgess of Columbia college is to deliver a course of ten lectures at Andover theological seminary during the spring, on 'The influence of the church in modern European history.'

— *Afrikanische nachrichten* is the title of a new monthly, which is published at the press of the geographical institute in Weimar. It is devoted to the extension of information concerning Africa, and will pay especial attention to German interests in that continent.

— The emigration at the German seaports and Antwerp amounted, during the first six months of 1886, to 39,477 persons. For the same period in 1881 it was 126,139; in 1882, 117,801; in 1883, 94,145; in 1884, 90,301; in 1885, 63,345.

— An excellent idea may be obtained of what subjects are of greatest contemporary interest to the leading universities abroad by an inspection of the list of lecture-subjects announced. For the Hilary term at Oxford, for example, the following are some of the courses announced by the leading professors: Professor Bryce announces a course on some leading principles and maxims of Roman law, with illustrations from the Digest; Professor Dicey, on the law of contract, and on succession to real and personal property; Professor Burdon-Sanderson, on the physiology of the nervous system; Professor Sylvester, on surfaces of the second order; Professor Jowett, on the history of Greek philosophy from Thales to Socrates; Professor Nettleship, on the history of Latin literature from the earliest times to the end of the second century B.C.; Professor Wallace, on moral psychology, and on the relations of ethics and aesthetics in German philosophy from Kant to Schopenhauer; Professor Fowler, on the Aristotelian logic, on the methods of the various sciences, and on the principles of legal and historical evidence; Prof. Bonamy Price, on free trade and fair trade; Professor Palgrave, on the sculpturesque and pictorial styles in ancient and modern poetry.

— Mr. Bardeen of Syracuse announces for sale an uncut copy of the 'Orbis pictus' of Comenius. Only one other copy is known to be in America.

— Prof. Max Müller is to lecture at Oxford during the present term on the Vedas.

— We learn from the *Athenaeum* that Professor Bain is about to publish a new and enlarged edition of his 'Rhetoric and composition.' In this edition the author proposes to omit a number of the topics comprised in the existing work, and to bestow a greatly expanded treatment upon points selected on account of their importance as well as their suitability to pupils of a certain standing. In part i. the subjects are, order of words, number of words, the sentence, the paragraph, figures of speech, and intellectual qualities of style. The second part, which will speedily follow, is exclusively devoted to the emotional qualities of style, and is meant to be an introduction to the higher criticism of poetical literature. The first part will be accompanied by a small volume entitled 'On teaching English,' which is partly controversial and partly didactic. It discusses the various methods of English teaching at present in use, and exemplifies the rhetorical method in a series of select lessons. It also handles at some length the vexed question of the definition of poetry.

— Captain Gore of the royal engineers is to construct the new map of Afghanistan from the surveys, reconnaissances, and explorations made by the Afghan boundary commission.

— The healing-springs of Bosnia and Herzegovina seem destined to occupy a prominent place among the health-resorts of the world. Professor Ludwig of Vienna, in the course of an official journey recently, discovered over fifty medicinal springs. The best are those at Banjaluka, Serajewo, and Dolnja-Tuzla.

— According to the newest and best maps of New Guinea, that region, including the small island lying near its coast, has an area of not less than 795,223 square kilometres. Of this territory, 390,560 square kilometres are under Dutch protection, 225,463 under English, and 179,200 under German.

— During the holidays a meeting was held at University college, Toronto, to organize a modern-language association for the Province of Ontario.

— *Modern-language notes* announces that Professor Crane of Cornell university is preparing an extensive work on the great mediaeval collections of Latin stories, their sources and imitations in the modern languages. A large part of the material has been taken from unedited manuscripts in the British museum and National library at Paris, or from early printed books. Among the former class are the *exempla* or illustrative stories contained in the sermons of Jacques de Vitry, bishop of Acre and the historian of the Crusades. Although these stories are of the greatest value for the question of the diffusion of popular tales, they have never before been edited. Professor Crane's work, which is entitled 'Mediaeval story-books and stories,' will cover the entire range of mediaeval Latin fiction, including *contes dévots*, fables, apologues, historical anecdotes, jests, etc., and will be valuable not only to the student of comparative literature and folk-lore, but also to those interested in mediaeval culture and history.

— In order to aid the law-students in the study of the year-books and other legal documents in Norman French, the trustees of Columbia college have provided a lecturer on Norman French for the law-school.

— The December issue of the Johns Hopkins university circulars contains the report of Prof. W. K. Brooks on the Zoölogical work of the university since 1878, and also a series of papers on the work of the marine laboratory during the past summer.

— From time to time the English papers publish reports as to the health of Mr. Herbert Spencer. It is now said to be improving.

— The *Athenaeum* announces that the second volume of Professor Pfleiderer's 'Philosophy of religion,' now in the press, will include not only many corrections and additions by the author, but also some new matter on the English philosophers of the present day.

— The present series of free public lectures at Columbia college, which it is hoped will become a permanent institution, was opened on Saturday, Jan. 8, by William Henry Bishop, who spoke on 'Characters and dialect in fiction.' Last Saturday Mr. E. A. Nadal lectured on 'Recollections of the south.' Tickets for these lectures are issued because of the limited capacity of the lecture-hall, but they may be obtained free of charge by addressing the registrar, Columbia college.

— Those who have followed the Irish question in British politics, and who have read Mr. Gladstone's 'History of an idea,' will be interested in the presentation of the opposite view by Lord Brabourne. This was first printed in *Blackwood's magazine*, but is now issued separately.

— In the January number of the *Andover review*, Prof. George H. Palmer of Harvard defends his view of the elective system against its critics, and closes the discussion on that subject which has been going on in the columns of the review for a year past.

— 1,800,000 francs have been subscribed to establish the Pasteur institute in Paris. Some of the largest contributions have been received from English brewers, as a token of their appreciation of Pasteur's work in connection with fermentation.

— The New York cremation society, which has its crematorium at Fresh Pond, Long Island, has incinerated eighty-four bodies during the past year.

— M. Peyraud considers one of the best means of determining the death of an individual to be cauterization by Vienna paste. If the eschar forms slowly, and is of a yellow color or transparent, death may be positively delared, while, if it is red, brown, or black, life still exists.

— The following officers were elected at the annual meeting of the Appalachian mountain club in Boston, Jan. 12: president, Prof. Alpheus Hyatt of Cambridge; vice-president, Robert C. Pitman of Newton; recording secretary, Rosewell B. Lawrence; treasurer, Gardner M. Jones. Committees: on natural history, George Dimmock of Cambridge; on topography, Prof. E. E. Burton; on art, Charles W. Sanderson; on explorations, Frank O. Carpenter; on improvements, Isaac Y. Chubbuck. Trustees, Professor William H. Niles of Cambridge, Augustus E. Scott of Lexington,

Charles W. Kennard. It was also voted that the admission-fee be hereafter five dollars.

— Since our last issue two men have died who have been prominently connected with the science of America. The one was Gen. W. B. Hazen, the head of the U.S. signal service, and the other Prof. E. L. Youmans, to whom Americans owe a debt for his successful labors in rendering available to them much of the best scientific thought of the time.

— As is usual, the *Athenaeum* prints in its first January number a series of essays on the continental literature for the past year. The article on French literature is by Gabriel Sarrazin, and contains incidentally a savage denunciation of M. Zola. The article on Germany, from the pen of Hofrath Zimmermann, is as interesting as usual. Arminius Vámbéry writes of Hungarian literature, and R. Bonghi of that of Italy.

— The *Woman's journal* has been emphasizing the well-known fact that female teachers greatly preponderate in this country. To so great an extent is this true, that, in respect of elementary schools, those cities are the exceptions in which male teachers are employed, save as principals, or teachers of some special branch, say, German. Taking the ten cities of Baltimore, Boston, Brooklyn, Chicago, Cincinnati, New Orleans, New York, Philadelphia, San Francisco, and St. Louis together, there are 12,719 public-school teachers, of whom 11,540 are women. The average percentage of male teachers in these cities is 9.

— The entrance of Sir Henry Roscoe upon a political career necessitates the giving-up of his chair at Owens college, Manchester. Mr. H. B. Dixon of Trinity college, Oxford, has been called to succeed him.

— The *Educational times* says that "the friends of education have much reason for rejoicing in the fact that a large number of the memorials which are to render her majesty's jubilee memorable will take an educational form. Technical schools, colleges, and endowments of professorships will be, in many cases, the visible signs by which contemporary English loyalty will be evidenced to unborn generations."

— According to the *Journal of education*, the modern Greeks are, in one respect at least, aiming as high as the ancient Greeks: they are beginning to conquer the world — the world, at any rate, of the east — by culture. A correspondent of the *Journal des débats* gives some account, in this connection, of the great advance which higher education in Greece has made of recent years. There are 33 gymnasia in the kingdom, 200 secondary schools, and 1,717 primary schools. These are all public. Among the private educational establishments, the first place must be given to the Society for the higher education of women, in connection with which a lycée for girls was established a few years ago, with a staff of 76 teachers and 1,476 pupils. Greeks send their girls there from all parts of the east. Education is very liberally endowed in Greece; and the sums which Greeks settled in foreign countries send home for this purpose are very large. One result, of course, is that the Greeks are almost entirely in possession of the learned professions in Turkey. Illiteracy, too, is rare in the kingdom: in the most out-of-the-way hill countries you will see little scholars reading their Plutarch's 'Lives.'

— The Standard typograph company, whose typograph was described and illustrated in *Science* for Sept. 17, 1886, have published a little pamphlet calling attention to recent improvements in their machine. By the use of 'slugs,' or strips of metal, instead of a single sheet, the lines of type-impressions may be spaced or 'leaded' any desirable distance apart, in the same manner as ordinary type. The use of what is known as 'self-spacing' type, that is, type whose width of face is a certain determinate multiple of an established unit, removes some, though not all, of the difficulty in 'justifying' or spacing uniformly between the words. These two points are decided improvements; but the specimens of work given in the pamphlet show that many of the defects and imperfections previously mentioned in *Science* still remain.

— In lecturing before the Society of natural history at Berlin, Professor Stricker has employed with much success an electric lamp of 4,000 candle-power for the projection of microscopic sections upon a screen, employing a magnifying power of six to eight thousand diameters. It is stated that the definition obtained is very satisfactory.

— In a letter to a London newspaper, Sir Edward Watkins advocates a system of experimental boring, by the British government, with a view to discovering natural gas in England. The many advantages derived from the use of such gas at Pittsburg and elsewhere in Pennsylvania are stated as incentives to the undertaking of such work by the government.

— A new type of submarine torpedo-boat is being experimented with at the West India docks, London, England. The peculiar feature of the boat is the means adopted to secure immersion or flotation, which consists in increasing or reducing

her displacement by projecting or withdrawing telescopic chambers in her sides, instead of pumping water into or out of ballast tanks, the method usually followed in similar boats. The boat is spindle-shaped, 60 feet long and 8 feet in diameter amidships, built of ⅝-inch steel, and is propelled by an electric motor of 45 horse-power, current being furnished by storage batteries.

## LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Popular science.

IT is often very popular indeed. Here is an article on the voices of animals by Detler von Geyern (whoever he is), from *Ueber Land und Meer*, translated for the *Popular science monthly*, January, 1887, written in the good old traditional vein, quoting what anybody has said on the subject in a wonder-mongering way, as if every thing said and written must be true. And Herr von Geyern himself says, "Fish can produce no sound in water, because air is lacking as a medium to propagate the waves of sound; and yet we incline to the belief that water itself may admit of forming some kind of sound-waves which the fish may be capable of exciting, and which will be experienced and comprehended by other fish;" and he adds, "As far as we are concerned, of course, fish will remain mute," etc. — as if between fifty and a hundred species of fish are not known to make sounds, many of which have been described and explained by naturalists; and as if water and every other elastic medium were not well known as propagators of sound, often better than air, — a fact familiar to boys, who hold their heads under water, while bathing, to hear the loud sound made by the striking-together of two stones under water in the hands of a companion at a little distance. H. W. P.

Grinnell, Io., Jan. 14.

### The natural method of language-teaching.

I read with much pleasure the recent article of Professor Carpenter on the natural method of teaching languages. Such articles are in the direct interest of truth, and therefore of science; for the more the claims and achievements of the teachers of these methods are scrutinized, the more evident their weakness becomes. Every intelligent teacher knows that there is little if any thing really new in any of these methods, and every good teacher of languages has employed several, if not all, of their varieties and sub-varieties, each of which is superior to the others in the opinion of their self-styled inventors. We are safe in assuming that the natural method of learning a foreign language is at least as old as the time of Cain, for it is both probable that he learned the language of the people of Nod, and that he used neither grammar nor dictionary.

I believe, that, in the main, great improvements have been made recently in the teaching of languages, but not greater than, or even so great as, in the natural and physical sciences, as they are commonly called. For some reason the teachers of the last two have either been more modest in proclaiming their progress, or they have been more generally aware that they are only employing methods that the best teachers in these departments, as in all others, have been using to a greater or less extent ever since the birth of science.

Several years ago I took considerable pains to examine, both at first-hand and at second-hand, the claims of several of the most widely known teachers of natural methods as applied to foreign languages. I then made some statements that agree almost verbatim with those made by Professor Carpenter. In spite of the well-established fact of every-day experience, that the adult is able to retrace but very imperfectly the psychological experiences of his early years, we are told that all persons, no matter how old, should, if desirous of learning a foreign language, proceed exactly in the same way that they learned their mother-tongue. This is the inductive method run riot, while experience and generalization count for nothing. To me the best refutation of the claims of most teachers of natural methods lies in the fact, that, while professing to be able to teach us to "read, write, and speak their vernacular correctly in an incredibly short time," I have not yet found one or heard of one who spoke English more than passably, even after years of practice. Shall we say, 'Physician, heal thyself'? or shall we excuse their shortcomings for the reason that 'physicians never take their own prescriptions'? CHAS. W. SUPER.

Athens, O., Jan. 16.

### Stereoscopic vision.

The letters in the last two numbers of *Science* (ix. Nos. 204, 205) in relation to stereoscopic vision lead me to ask if any of your readers have ever tried the experiment of viewing a stereoscopic picture with the naked eye, and, by changing the focal distance, or visual angle of the eyes, so adjusting them, while looking at the picture, or, more properly, the two pictures, that the full stereoscopic effect is produced, and all parts of the picture stand out distinct, and in as bold relief as when seen through the two glasses. The first effect of the change of the visual angle, from the paper on which the pictures are imprinted to a more distant range of vision, is to double the number of the pictures, four now coming into view. The two inner ones overlap more or less, and slide over each other to right and left, as the visual angle undergoes alteration, until finally, when the proper adjustment is reached, the two pictures coincide in all their parts, coalescing, as it were, like two drops of water or two globules of quicksilver when they meet and run together. And now there are three pictures in view, and the eyes may be turned about from one point to another, and any part or particular object in the picture minutely inspected in any one of the three copies. The central picture is the most clear and distinct, being held in view by both eyes, while the two outer ones are respectively visible to only one eye. W. W. ANDERSON, M.D.

Stateburg, S.C., Jan. 13.

### An electric ball of fire

In the summer of 1881 it was my good fortune to observe some electrical phenomena in the way of 'globular lightning,' which differ, I think, in some respects, from any other case on record. It consisted of a ball of fire which rolled down an iron water-

pipe, which pipe enters the room at a height of about ten feet, and, passing downward, ends in a faucet over a zinc-lined sink, the sink being connected by a pipe with the ground. The ball of fire was about an inch and a half in diameter, of a semi-transparent bluish color, giving a feeble light, which first appeared at the top of the pipe, and rolled down it at a nearly uniform velocity of six or eight feet per second, and, upon reaching the faucet, fell into the sink with a report about as loud as the discharge of a gun-cap. We at once examined the sink, but found no trace of any thing. But, as we stood watching the pipe, the same phenomenon was twice repeated, making three discharges in the course of ten minutes.

This occurring, as it did, five years and a half ago, I am unable to give as accurate an account as I might wish. There were twelve or fifteen persons in the room at the time, some of whom I have since seen, and all agree. In regard to the location, it was in the Sunset Hill house on Sugar Hill, in the White Mountains, about seventeen hundred feet above the sea. The pipe which supplies water to the house comes from a spring on the mountain-side, and, passing up through the wall, leads to a reservoir on the roof of the kitchen.

The pipe on which the globular lightning was seen is a branch of this main pipe. On its way to the upper story — starting from a height of about ten feet, it comes out of the wall, and passes downward at an angle of about 30° with the vertical, ending in a brass faucet over the sink. The pipe was of wrought iron, covered inside and out with a coating of coal-tar to prevent rusting.

The phenomena described occurred during a heavy thunder-storm, and, so far as I can learn, nothing of the kind had ever happened there before, nor has it even been repeated. N. C. WARDWELL.

Hartford, Jan. 10.

## The genesis of the diamond.

In an interesting communication under this title, Prof. H. Carvill Lewis gives in No. 193 of *Science* an apparently satisfactory theory of the structure and origin of the diamond-bearing necks of South Africa and of the genesis of the gem in that region. The discovery of undecomposed peridotite as the original form of the puzzling blue ground confirms the suspicion long entertained by my friend, Prof. Henri Goraix, and myself, that very slight analogies, if any, exist between the South African and Brazilian diamond-fields, in the latter of which we have, as we think, traced the diamond to its original matrix. Communications on the subject will be found in the *American journal of science* for February and July, 1882, by myself, and in papers by Professor Goraix in the *Comptes rendus de l'académie des sciences* and *Bulletin de la Société géologique de France* of 1884.

The main points of these papers may be briefly summarized as follows. The diamond region about the city of Diamantina, in the province of Minas-Geraes (the oldest and best-known diamond-field of Brazil), consists geologically of very ancient and profoundly disturbed metamorphosed strata, which may be divided into three groups: 1°, wholly crystalline rocks, gneiss, mica-schists, etc.; 2°, less perfectly crystalline rocks, unctuous schists, quartzites (itacolumites), iron ores (itabirites), and limestones; and, 3°, quartzites. The first two groups form the nucleus of the mountainous diamond-bearing region, No. 2 greatly predominating over No. 1. No. 3, which in hand specimens (and often in the field as well) can only with difficulty be distinguished from the quartzite of group 2, with which it has up to the present been very generally confounded, lies in undulating folds over the upturned edges of Nos. 1 and 2, and at times passes to a conglomerate including fragments of both the older groups. The geological age of these groups is undetermined, but the newest of them can scarcely be younger than the Silurian, and, if not older, belongs more probably to the earlier than to the later part of that age. The eruptive rocks thus far recognized in the diamond district are granites, diabases, gabbros, and serpentinous rocks, which very probably were originally peridotites. It should be remarked, however, that the latter are apparently far less abundant than in the region farther south in the same mountain-range, in which diamonds are only found rarely, or, over large areas, not at all.

The greater part of the diamond-washing, being in river-alluviums or in gravel-deposits on the uplands, gives no clew as to which of the three groups or of the associated eruptions may have furnished the gems. A few of the upland gravel-deposits are evidently decomposed but undisturbed conglomerates belonging to group 3. The famous Grao Mogol locality described by Helmreichen, Claussen, and Heusser and Clary, where diamonds are found embedded in a hard quartzite with a conglomeritic character, belongs also, in my opinion, to this group; the diamond entering, like the other elements, as a rolled pebble. Professor Goraix, however, who has had the advantage of a personal examination of the locality, refers the diamantiferous rock to the quartzites of group 2, and admits the possibility of the genesis of the gem *in situ*, though he does not insist very strongly on this point. The difficulty I have often experienced in distinguishing the quartzites of the two groups one from the other, even when they are in juxtaposition in the same section (as I believe Professor Goraix admits them to be at Grao Mogol), leads me to the apparent presumptuousness of maintaining my opinion against that of so acute and conscientious an observer.

At a single locality, Sao Joao da Chapada, the miners have penetrated deeply the decomposed but undisturbed schists of group 2, extracting the diamond from a decomposed vein-rock from which Professor Goraix took out, with his own hands and with all possible precaution against error, several of the precious stones, after I had expressed to him the opinion that it was the veritable matrix of the diamond. Three veins of somewhat different character have been recognized. One is of quartz with plates of specular iron, to which the diamantiferous *barro* (clay) adheres. This last is an earthy mass rich in iron, which gives, on washing, an abundance of microscopic tourmaline. This last circumstance, with the abundance of iron, suggests a comparison with the peculiar auriferous veins of quartz, pyrites, and tourmaline of the vicinity of Ouro Preto in the same geological horizon, and in very similar conditions. The other veins are without quartz, and consist of a lithomarge-like clay charged with oxides of iron and manganese, which, as Professor Goraix states, bear a strong resemblance, both in composition and geological occurrence, to the topaz and euclase bearing viens of the vicinity of Ouro Preto. These veins are coincident with the

bedding, or nearly so. Besides quartz and tourmaline, they carry iron and titanium minerals (magnetite, hematite, rutile, and anatase), amorphous chloro-phosphates of some of the rarer elements (cerium, lanthanum, didymium, etc.), and, almost certainly, euclase.

The observations at this place exclude completely the idea of peridotite or other eruptive rocks. The diamond at Sao Joao da Chapada, and presumably at other Brazilian localities, is a *vein mineral*, and the conditions of its genesis (unless we admit the hypothesis of a subsequent deposition of carbon, which is uncalled for by any of the observations thus far made) must have been such as were favorable to the segregation of iron and titanium oxides, phosphates of rare elements, and certain silicates, such as tourmaline and presumably topaz and euclase. The hypothesis of a genesis through the reaction of eruptive masses on carbonaceous schists is here as inadmissible as would be that of a vein formation for the South African mines. If the origin of the carbon is to be sought in the rocks traversed by the eruptive or vein masses containing it, it is not without interest to mention that the schists of the veins in which the Sao Joao mine is excavated frequently contain graphite, though at that particular locality they are too much decomposed to enable one to determine whether it occurs there or not. It may be stated, that, in the other diamantiferous regions of Bahia, group 2 occurs either at the mines or in sufficient proximity to have furnished the diamonds. In the Bahia fields the precious stones appear to have come mainly from a conglomerate which, as it lies in the prolongation of the same range, is presumably identical with group 3 above described, and, like it, rests on a base of unctuous schists, itacolumite and itabirite. The Goyaz fields and those of Bagagen in western Minas seem to be similar to those of Diamantina, though perhaps lacking the upper quartzite. To the west of Diamantina, in the San Francisco valley, diamonds are washed from the *débris* of a conglomerate presumably of upper Silurian or Devonian age, but containing pebbles of the Diamantina rocks. In the province of Paraná the immediate origin is in a Devonian conglomerate, and this is also apparently the case with the diamantiferous placers of the province of Matto Grosso.

The Brazilian and African diamond-fields thus indicate two very distinct modes of occurrence and genesis for the gem, — one as a vein mineral accompanying oxides, silicates, and phosphates; the other as an accessory element in an eruptive rock. In the last number of the *Bulletin de la Société géologique de France*, M. Chaper presents a third mode of occurrence as the result of his observations in an Indian diamond-field. He satisfied himself that the gem occurs there, along with sapphires and rubies, in a decomposed pegmatite, having taken out two diamonds, two sapphires, and three rubies from an excavation made in that material. The circumstance that all these stones were found during the preliminary work with pick and shovel, whereas nothing was found in the washing, would, notwithstanding M. Chaper's confidence that no deception was practised, seem to the practical diamond-miner to be extremely suggestive of *salting* very inartistically done. The occurrence of remnants of a sedimentary formation of a conglomeritic character in the neighborhood of the old washing examined suggests another explanation for the occurrence of the gem in placers resting on a bottom of granitic rocks.

ORVILLE A. DERBY.

Museum nacional, Rio de Janeiro, Dec. 16.

### A German sentence.

Will you allow me a brief reference to a remark of one of your contributors? 'M.' quotes the following German sentence by 'one of the most distinguished German zoölogists:' —

"Man darf für wahrscheinlich halten, dass die so sehr wechselnde Gestalt und Ausbildung der 'Tastborsten,' nach der Art des Thieres und den Körpergegenden, noch bestimmten Nebenzwecken zu dienen hat, ohne dass wir uns davon Rechenschaft zu geben vermögen."

In the original quotation the commas after 'Tastborsten' and before 'noch,' etc., are omitted. 'M.' quotes this as a sample of sentences which prove that German scientific writers despise the 'French qualities of grace and lucidity.'

He goes further than this. He is quite convinced that the scientific men in Germany show an 'absence of the literary sense,' though he admits there are some exceptions.

It seems to me that if 'M.' wished to furnish a proof for his assertion, he ought to have chosen a different sentence. Evidently every thing depends upon the reader for whom the sentence was intended. If the author wrote for children, his sentence was objectionable; but, if he wrote for educated persons, the sentence must be pronounced just as clear, lucid, and elegant in German as any similar sentence might be in French. 'M.' assumes to judge of the literary qualifications of people who use a language with which he himself is less familiar than he is with French and English; a language, moreover, which greatly differs in its laws of construction from French and English. Supposing he should apply his French or English standard to a similar Latin sentence by one of the recognized masters of Latin style, would the difficulty of understanding its meaning justify a person who is not perfectly at home in that language to condemn the form of the sentence?

It seems to me 'M.'s' reasoning is the reverse of 'scientific.' It looks very much like 'jumping at conclusions.' 'M.' goes further than this. He remarks on the lack of German inventiveness. But do the Germans lack inventors? They are inferior to the Americans in invention of labor-saving machinery, because they have not hitherto felt the need of it as much as Americans in their thinly peopled country.

But let us ask who invented watches, lithography, the original hand-press for printing, and the later revolving press, for the first time used in printing the London *Times*, which created a new era in newspaper printing? Who has a greater claim to the invention of the electric telegraph than Gauss of Göttingen, or Steinheil of München? Where are there more practical inventors than Krupp and the men that have made his steel-works famous all over the world? And how about Siemens (the two elder brothers), Halske, Schaefer, Budenberg, Gruson, and scores of others? Germany, so long disunited, could not afford a patent law like our own until quite recently: hence many of her inventors went to England, France, and some to this country.

There is some truth in 'M.'s' remark about the bad style of many German scientific writers, but I venture the assertion that the number of really fine

writers on science in Germany is as great as that of any other nation. I believe the following names, to which scores of others could be added, will bear out my statement: Georg Forster (the companion of Cook), A. von Humboldt, Liebig, Moleschott, Carl Vogt, Schleiden, Peschel, Helmholtz, Otto Ule (of Halle), Rossmaessler, Haeckel, Preyer, etc. Who is to be the judge as to a good German style, those who know the language as foreigners, or those who know it as natives? What would become of scientific criticism, if people may ridicule with impunity whatever differs from the standard to which they are accustomed? How does 'M.' suppose a rather long and involved English sentence, though correctly formed and considered elegant, sounds to a German who translates it literally? In a recent issue of *Science* (Jan. 7) another German sentence is quoted; and this, too, is neither a bad nor an obscure one, although it is not claimed that an advertisement— and such the sentence is— may be taken as a model of a lucid and graceful style. The number of poor writers in German is not great, in spite of all that has been written on the subject. The number of finished writers of peculiar excellence is probably as great in Germany as in France, England, or the United States. C. A. EGGERT.

Iowa City, Io., Jan. 7.

## The West Indian seal.

Since the publication of my article on this species in the last number of *Science* (ix. 35), Mr. F. W. True of the U. S. national museum has kindly called my attention to a paper on this subject by himself and Mr. F. A. Lucas, in the Smithsonian report for 1884 (part ii. pp. 331–335, plates i.–iii.), recently distributed, which I had not at that time seen. In this paper the species is positively referred to the genus Monachus, and the cranial characters are described and figured. The specimen forming the basis of this paper is the one presented to the U. S. national museum by Professor Poey, as stated in *Science*, iii. 752. This was a skin, containing the skull, of the specimen taken near Havana in 1883. The specimen is described as "a female, . . . apparently adult, though not aged." The description of the size and color, and the figures of the skull, however, show it to have been quite young, not more than two-thirds grown, and probably in its second year, the skull-sutures being still open, while in the adult, as in other seals, those of the cranium proper are wholly obliterated.

On the assumption that their specimen was adult, Messrs. True and Lucas believe that "the West Indian seal must be considerably smaller than M. albiventer" of the Mediterranean. The specimens obtained by Mr. Ward show that there is practically no difference in size or color between specimens of corresponding ages of the two species of subtropical seals. Many of the discrepancies in the proportions of the skull in the two forms, alluded to by True and Lucas, are clearly due, in large part at least, to the immaturity of their specimen of M. tropicalis. My largest male skulls even slightly exceed the measurements given by Cuvier for the Mediterranean species. I find the length of my adult male skeleton, measured along the curvature of its axis, to be seven and a half feet; measured in a straight line, seven and one-tenth feet, or 85 inches. The length of the stuffed skin of the Havana specimen, as given by True and Lucas, is only 53 inches. In view, however, of the widely separated habitats of the two forms, there is every probability of their specific distinctness, and adequate material doubtless would reveal numerous minor structural differences.

As compared with other species of the family Phocidae, the skeleton of M. tropicalis presents notable peculiarities, particularly in the form of the scapula, the pelvis, the proportions of the limb-bones, etc., as well as in the low position of the mandibular condyle, referred to by True and Lucas. The scapula, for example, is remarkably short and broad, the length to the breadth being as 16 to 28, both the anterior and posterior borders being greatly developed. The acromion process is well marked; but the spine is low and short, forming little more than a well-marked ridge, in comparison with its usual development in other phocids. The pelvis is remarkably short and broad: the thyroid foramina are fully half as broad as long. The femur is very short and thick, not longer than in Phoca vitulina, notwithstanding the much greater size of the animal, the same being true likewise of the pelvis. Throughout the skeleton the proportion of parts is rather exceptional, the fore-limbs being much more developed, relatively to the hind-limbs, than in the seals generally. As I stated in 1870 (*Bull. mus. comp. zoöl.*, ii. No. 1, p. 30), Monachus much more nearly approaches the Otariidae than does any other genus of the Phocidae, through its skeletal proportions and peculiarities. The animal is in form very robust. The bones are thick and heavy, with the apophyses of the vertebrae strongly developed. Further details, however, must await the appearance of my illustrated memoir on this species, now in preparation for early publication in the Bulletin of the American museum of natural history.

To Messrs. True and Lucas is due the credit of first making known, in their paper above cited, the cranial characters of the West Indian seal, and of confirming its reference to the genus Monachus; and I much regret not having seen their valuable contribution when I penned my former notice of the species. While the 'Report' containing their paper bears date '1885,' it appears not to have been generally distributed till some time in December, 1886.

J. A. ALLEN.

New York, Jan. 14.

## On hybrid dogs.

If my memory serves me correctly, I think it was Dr. Coues who pointed out the fact somewhere, in one of his works, that he had personally known of cases of fertile crosses having taken place between the coyoté (Canis latrans) and that species of semi-domesticated dog found with nearly all the Indian tribes of this country. His instances were cited, however, I believe, for the Sioux camps of the Indian agencies of certain parts of Dakota.

Now, a year ago there came under my observation here an interesting case of this kind, the occurrence having taken place at Zuñi, in south-western New Mexico. Zuñian Indians have many varieties of wolfish-looking dogs at their pueblo, while coyotés are always found prowling about on the surrounding prairies. Such circumstances as these, granting that these animals will cross, are as favorable as any we could imagine; for the pueblo, with the ends of its streets leading in the majority of instances directly out upon the prairie, affords the opportunity, not

only for the dogs to run out upon it at night, but the coyotés, long since accustomed to the sight of the pueblo and all that is in it, to approach with less suspicion than they would even about an Indian camp. Moreover, some of these Zuñian dogs have very much the appearance and behavior of the coyotés themselves, and quite as much cunning in some instances. Among the rarer varieties of the former we sometimes find a sheep-dog of apparently the same breed of animal often seen in certain parts of the eastern states. I refer to the black-and-tan variety, with the shaggy coat, and the tan-spots, one over each eye. The trader at Zuñi, an observing and intelligent Englishman, has long owned one of this latter kind, — a bitch of excellent qualities, — and it is from this gentleman that I came into possession of the following account. He tells me that a little over three and a half years ago, the opportunity was afforded him to become personally cognizant of the fact that this shepherd-dog bitch of his was lined by a large male coyoté one evening just beyond the limits of the pueblo. In due time she gave birth to four male pups, that looked curiously like young coyotés from the hour they were born. When I came to Wingate here, all four of these dogs were fully grown, and were owned by different parties at the garrison, and I had excellent opportunities to study them. They all very much resembled each other, and the entire progeny are the very exemplification of what we might easily imagine the offspring of such a parentage would be. Taking any one of them as an example, it is to be noted that the animal has a form somewhat heavier than a coyoté, and yet more slender and agile than a shepherd-dog. As we would naturally expect, its pelage is rather long and shaggy, with a handsome flag to its tail. In color it is a fine stone gray, inclining to blackish on the flanks and sides; the spots are absent from over the eyes. The ears have more of the form of the coyoté's than they have of the ears of the mother; while the fore part of the face, and the muzzle, more nearly approach that of a shepherd-dog. One of the most interesting features of it all is to hear one of them bark; for those who may be familiar with the despicable howl of the prairie-wolf can here have the opportunity to fully appreciate how much that kind of music can be improved by being semi-modified by such crossing in stock. The yelp becomes softened, and the more intelligent expressions of the bark are introduced, though in the present case these seem to be about equally divided in the voices of these hybrids.

When out of the garrison, I have observed much in their behavior that reminds me of the coyoté, more than it does of the dog. They run and trot like a coyoté; and when off at a distance they have a way of standing sidewise as motionless as a statue, and regarding you; while at such times they keep their two fore-limbs together, as well as the hinder ones. Such a position is very commonly assumed by the prairie-wolf, and may be said to be a direct lateral view of the animal, with its face looking towards you.

Space will not permit me to enter upon the many little interesting traits of these animals, which plainly are due to the crossing of the parent stock, and have been inherited by the issue.

It is my present aim to purchase one of these animals, if possible, with the view of securing its skeleton, more especially its skull. This latter would undoubtedly make an interesting thing to compare with Huxley's valuable work on the skulls of the Canidae. I have collected a fine series of the skulls of the coyotés, and have them in my possession at the present writing. R. W. Shufeldt.

Fort Wingate, N. Mex., Jan. 11.

### To authors of text-books on physics.

The definition of the coefficient of elasticity, given by Professor Baker on p. 34 of the current volume, is vitally defective because the unit of section is omitted. It reads, "The coefficient of elasticity may be defined as the force which would double the length of a bar." According to this, if the section of one bar were twice that of another, all other things being equal, the coefficient of elasticity of the former would be double that of the latter, which is not true. A student might further object that solids cannot be elongated to double their length, nor liquids be compressed to half their volume, or, if they could, the coefficient would not remain constant during the operation. Strictly speaking, the coefficient of elasticity is a *rate*, and may be defined as the rate of change of the stress per unit of section to that of the elongation per unit of length. This is true for the incipient elongation due to an incipient stress. If it be *assumed* that the section of the bar remains uniform and the elasticity remains perfect during the elongation, then it will be true that the coefficient of elasticity equals the force which would double the length of a bar whose cross-section is unity. DeVolson Wood.

Hoboken, N.J., Jan. 15.

### H. Allyne Nicholson.

In answer to a letter of condolence written in consequence of the press despatches announcing the death of Prof. H. Allyne Nicholson, Dr. C. A. White has received a letter from Professor Nicholson himself, saying that he is not dead, but alive and well.

If the above has not been announced, it may be of interest to the readers of *Science*.

Edw. J. Nolan.

Philadelphia, Jan. 17.

### Abbott's Greek reader.

I like the freshness and independence of your critical comments. But you object to the publishers of Abbott's 'Greek reader' binding the notes separately from the text. 'Much' may be 'lost in convenience,' as you say, but some of the best instructors in the classics object to notes in the classroom, in the hands of the student. They are entirely too convenient, a great hinderance to the best mental discipline, and a temptation to neglect thorough preparation beforehand. E. T. Jeffers.

Lincoln univ., Chester co., Penn., Dec. 29.

### Advertising for professors.

*Science and education* for Dec. 24, on p. 65, speaks of advertising for professors.

The University of Mississippi recently advertised. There were five vacancies and five hundred and twenty-seven applications! M. W. Easton.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 21, 1887.

## *THE UNIVERSITY EXTENSION MOVEMENT AT CAMBRIDGE.*

THE university extension movement was begun at Cambridge about fifteen years ago. It occurred to some energetic men, especially to Professors Stuart and Sidgwick, that the university should attempt to influence the education of the country not only by examinations, but by direct teaching. It was thought that young men were sent out every year by *alma mater* for whom there was no place in the teaching system of the university itself, but who might find a field of activity in the great towns of England. The system has grown up from very small beginnings. At first a private enterprise, it shortly became part of the university organization, and it is now a recognized department of university work. During the last six years the growth has been very marked. In 1880 there were thirteen centres, in 1885 there were thirty-six. In 1880 thirty-seven courses of lectures were delivered; in 1885, eighty courses. The attendance at lectures, which in 1880 was 4,300, rose in 1885 to 8,500. The movement has spread all over England. The miners of Northumberland form a numerous and intelligent audience. There is a centre at Torquay and a centre at Portsmouth, but, as might be expected in England, the northern centres far outnumber the southern. London is the seat of a separate management under the joint government of the two universities, which extends its ramifications into the suburbs. Hitherto the teaching has been scattered over the country without any definite order or arrangement. Each centre has chosen that subject which seemed to suit it best. There have been examinations with classes and marks of distinction, and a certificate has been given by the vice-chancellor of the university, but there has been no systematic and continuous arrangement of teaching analogous to that which exists in the university itself. This want will now be supplied. The university has determined that attendance at certain courses of lectures, tested by examinations and marked by a certificate, shall take the place of a certain amount of residence at the university. When this scheme is put into working order, we shall have a system of academical teaching extending over the whole country, and directly connected with university degrees. No more efficient means can be found of connecting the old English universities, which have too often been considered as hot-beds of clericalism and toryism, with the growing life of the nation, especially in the most democratic districts.

Let us now see how the system practically works. A town wishes to establish a course of extension lectures. The first business is to elect a committee, and to raise the necessary funds. The session extends from September to April, and occupies two courses of three months each, either of which may be taken separately. The lecturer is paid forty-five pounds for twelve weeks, the last week in each term being devoted to examinations. When it is found that funds can be provided either by subscriptions or by the sale of tickets, communications are opened with Cambridge. If the town is situated in the neighborhood of other towns which have previously established courses, matters can be arranged on a more economical basis. The university informs the town what lecturers it has at its disposal, and what courses they are able to give: the town determines what kind of lectures it desires to receive. The subjects vary very much. The northern miners are keen for instruction in science: suburban ladies prefer the literature and art of mediaeval Italy or Germany. The lecturer belongs to one of two classes: he is either a man who has taken up this occupation as a profession, whose reputation is well known, and who occupies a position not inferior to that of a recognized university teacher, or he may be a young man who has just taken his degree, a senior wrangler, a senior classic, or a senior historian, who looks upon the occupation of university extension lecturing as one of the best openings available for an ambitious and successful career.

The first duty of a lecturer is to prepare his syllabus. It was laid down at the commencement of the scheme that every lecturer must, before he begins his work, write an elaborate syllabus, partly as a guaranty that his lectures are really good and thorough, but chiefly as an aid to his class in threading a difficult and unfamiliar subject. Two of these syllabuses lie before me, both by lecturers beginning their work. The first course, by a senior wrangler, is on work and energy: it consists of twelve lectures. The first, being introductory, is on the study of natural science, on its results, its methods, and the various

manners of discovering scientific truths. The second lecture is on the laws of motion, including a popular exposition of Newton's three laws. The third lecture is devoted to the examination of work, energy, and gravitation. In the fourth lecture certain simple machines are described, — the pendulum, the different kinds of lever, and the water-wheel. The next lecture deals with the nature of heat, and the sixth with the more elaborate theories of Mayer and Joule. The seventh lecture deals with light and sound, the eighth with chemical energy, the ninth and tenth with electricity and magnetism. The eleventh lecture is devoted to the conservation of energy and the manner in which it is transformed from one shape into another. The last lecture treats of the dispersion of energy, and concludes with an account of the sun.

It may be thought that this course is somewhat too extensive and ambitious, and its practical success remains to be proved by the examination; but no one can deny that it forms a brilliant attempt to deal in a single view with the main truths of physics.

The second course is of an entirely different character: it treats of the origin and early history of the English colonies in North America. Like the former, it consists of twelve lectures. The first lecture is devoted to ancient and modern systems of colonization, the Greek, the Roman, and the systems of modern states. The second lecture treats of the early voyages and settlements in America from Christopher Columbus down to the foundation of Quebec. Then follows the colonization and early history of Virginia, the colonization of New England, of Maryland, of the two Carolinas and Georgia; next come the Quaker colonies of New Jersey, Pennsylvania, and Delaware. In the eighth lecture we have reached the subject of the early colonial wars of France and England, from King William's war in 1689–97 down to the conspiracy of Pontiac in 1763. The condition of America in 1763 is then dealt with, with a sketch of each colony from the beginning of the eighteenth century up to that time. The tenth lecture treats of the war of independence; the eleventh, of the American constitution; and the twelfth and last, of the history of modern Canada down to the present day.

These syllabuses are printed in little pamphlets, and the chief criticism to be made upon them is that they are often somewhat too long and elaborate. Where so much is printed for a course, there is less room for detailed exposition. This, however, is a fault on the right side, which experience will prevent.

The lectures are given once a week, and last an hour. The hour which precedes or follows the lecture is taken up with what is known as 'the class.' In this the formal method of the lecture is abandoned, discussion of difficult points is invited, questions are put to the lecturer on any thing that appears obscure, or the lecturer gives additional details and illustrations. The class is open to all who attend the lectures, but in a series of years this is generally found not to exceed one-half. At the end of each lecture in the syllabus will be found three or four questions which are to be answered by the students at home; and help is freely given in the little pamphlet, as to the line to be taken in answering the questions, and the books to be used. These exercises are purely voluntary: the answers are sent to the lecturer, who returns them with corrections before the following lecture. The number of those doing papers is not more than one-third of those who attend the class, or one-sixth of those who attend the lectures. Finally, at the end of each term, an examination is held, conducted, not by the lecturer, but by independent examiners appointed by the university. The numbers examined form about one-fourth of the class, or one-eighth of the whole attendance at lectures. In connection with each course of three months, certificates are granted on the double basis of the lecturer's report of the weekly exercises and the examiner's report of the final examination. In this way is tested not only the capacity of getting up a subject and passing an examination, but the continuous effort of steady work throughout the term. It is very interesting to consider what classes of people are reached by the university extension lectures. Although the movement was first devised for adults, yet the lectures have been generally frequented by schools, and especially by girls' schools. They are useful in cases where a competent visiting lecturer cannot be obtained. Much more accessible to these influences are young people who have left school, and have not yet settled in life. This is the golden age for education, corresponding to the time spent at college by those who can afford it. From these classes, if from any, must be drawn the affiliated students whom the extension movement will link with the university. If the lectures are delivered at night, they are usually attended by clerks and shop people, who are at work in the day.

However, the most interesting field of work which the movement has yet found has been the artisans, and among these are pre-eminent the miners of Northumberland. Mr. Roberts, the organizing secretary, writes, after a fortnight's visitation to Northumberland, "I wish I could adequately describe the impression this fortnight's

work made upon me. The sturdy intelligence of the pitmen, their determined earnestness, the appreciative and responsive way in which they listened, the downright straightforwardness of their speech, — all these it is impossible fully to express. I am persuaded that in the Northumberland and Durham districts the pitmen are ripe for a scheme that will bring higher education and culture within their reach." The northern population is eager for knowledge, and travels long distances to seek it, in all kinds of weather, over the roughest of roads. Some persons here walked regularly six miles to hear the lectures. At Newcastle some travelled as much as ten miles to hear the lectures. Two pitmen, brothers, attended a course regularly from a distance of five miles: they went there by train, but were compelled to walk home. This they did for three months on dark nights, over wretchedly bad roads, and in all kinds of weather. One miner writes in gratitude, "I deeply deplore the last thirty-four years of my life. Being buried in the mines since I was nine years of age, and taught to look jealously on science as being antagonistic to religion, I little thought what pleasures of thought and contemplation I lost; I have, however, broken loose from my fetters, and am proceeding onwards." It is sad to think that this energy and hunger for learning should be cramped by inability to pay for it. Working-men can seldom afford more than one shilling or one shilling sixpence for a course, yet at two shillings a ticket it would take an attendance of seven hundred to make the lectures pay. Besides, the cost of the ticket is not the only tax on the artisan. Text-books must be bought, weekly papers posted to the lecturer, while wages are lost by attendance at the evening classes. The whole system requires a solid pecuniary basis to make it permanent; and that, up to the present moment, has not been forthcoming.

Although much has been done, we may hope for much larger developments in the future. A staff of thoroughly trained lecturers should grow up, who will make this occupation the work of their lives. The courses of instruction will be more systematic, and will be spread regularly over a number of years. In some cases the lectures will crystallize, as they have already done, into local colleges or small universities; in others they will remain in a more fluid state. Whatever may be the result of the movement, there is no doubt that the problem has been solved of bringing the highest university education within the reach of the lowest classes who are capable of receiving it. Such a movement may be less necessary in countries where education is more democratic, and where no class has been left out; but in England, where the higher education, like every thing else, is organized mainly for the privileged classes, such an enterprise is an incalculable boon.

Some few years ago, on a summer afternoon, a body of artisans were watching our Cambridge undergraduates amusing themselves on the river which flows by the backs of the colleges. Their conversation was overheard by a passer-by, and it was discovered that they were under the impression that all Cambridge undergraduates were sons of noblemen, and that no one could live at the university under a thousand pounds a year. This was the exaggeration of ignorance, but let us hope that the extension movement will in another generation render all such misunderstandings impossible.

OSCAR BROWNING.

## *THE TRAINING OF THE FACULTIES OF JUDGMENT AND REASONING.*[1]

I AM going to endeavor to show, as far as I have the power to do so, how the psychological and logical principles which relate to judgment and reasoning may be applied to the treatment of our ordinary school subjects, — what our methods of teaching should be, if we desire those methods to be framed in accordance with the laws and suggestions of mental science. I must refer you to Mr. Sully's indispensable 'Teacher's handbook of psychology,' for the discussion and full exposition of the psychological principles. But also, I shall begin by running over the chief points which require our attention, before I attempt to sketch my lessons, so that you may have the principles on which I work freshly in your minds. My desire, as you know, is not to upset or change this or that method of teaching this or that subject, but to bring the precepts and laws of psychology to bear directly on the actual practice of the classroom. In what I have got to say on the logical side of the matter, I am largely indebted to Mr. Jevons, to whose excellent and suggestive little book, 'Elementary lessons in logic,' I must refer you. And let me say here that I think every teacher ought to own the book, and to make a point of mastering especially the last ten lessons.

To judge is to connect two notions, two representations or mental images of what has been perceived; and the outward expression of this act is a statement in words, or a proposition. Thus, if we have acquired the general notions or concepts, say, of hardness and heaviness, we may connect either or both with any particular thing or class of things, or with any other notion. We may say, 'This ground is hard,' or, 'This table is

[1] From the *Journal of education*, a paper read before the Education society, Oct. 25, 1886.

heavy,' or, connecting two concepts, 'It is wise to be merry.' It does not matter how we have acquired the information, or by what mental process we have reached the assertion: we may say, using direct observation, 'This boy is tall,' or, making an inference, 'There will soon be another general election;' in either case we have given expression to a judgment. Of course, if we merely echo somebody else's statements, we give expression to his judgments, but we do not perform acts of judgment of our own, — a fact which young and old, in and out of school, are always forgetting. The work of connecting the two notions or mental images must be our own before we can be considered to have performed an act of judgment. The connection may be wrong or unwarrantable, but the formation of it will none the less constitute what we here define as judging; that is, if it be made with a certain amount of belief in the reality of the connection. If there be no such belief, we shall not consider the statement as the expression of a judgment. Our statements may either be affirmative or negative; about individuals or about classes, i.e., what are called 'singular' or 'universal' judgments, as, for example, 'This boy loves exercise,' 'Boys are fond of action.' In the case of negative judgments, we may suppose some one to have originally asserted a connection between two notions; and the mind has then to decide whether the assertion be true or not true (untrue). If it decides in the latter sense, the judgment will be a denial, not an affirmation, of the connection between the notions. We may, however, sometimes turn the judgment into the affirmative form, as thus: if we deny that 'this bag is heavy,' we say, 'This bag is not heavy,' i.e., 'This bag is light.' But this is assuming that there is no alternative to 'heavy' but 'light,' while we may easily conceive of a state which could not be described either as the one or the other. If there be several alternatives, still more must the statement remain negative. I cannot transpose, without changing the subject of which I speak, such a statement as 'This leaf is not green.' This is, however, rather a matter of logic than of psychology.

There is another point on which it will be of more importance to touch, — the relation of conception to judgment. We have seen that in the former there is a process of combining. The concept 'metal' is formed by mentally grouping together a certain number of qualities or properties, grouping them so as to make one complex mental image or representation. As Mr. Sully says, "The mind here comprehends the several qualities as together comprising one thing or substance. In judgment, on the other hand, we distinctly set forth two representations as two, keeping them apart from one another, while at the same time we connect them with one another. We think of certain objects or qualities as distinct, and at the same time explicitly view them as related." Thus, in affirming that 'iron is a metal,' we think of the quality of being a metal as something apart from the iron, something new which we assert to belong to it. In fact, we have here the same distinction as we have in grammar between the name with the attributes of the subject, and the predicate. To express a judgment, we must make use of a predicate, or give some new information about that of which we are speaking: in the case of a concept, we have merely the general notion, simple or complex, corresponding to the name and its attendant describing adjectives, or to the name alone. We must bear in mind, however, that many, if not all, concepts are formed by a succession of judgments. Every addition to our knowledge of the properties or qualities which correspond to a general term takes the form of a judgment. The very bringing of things together on the ground of their likeness, or the separating of them because of their dissimilarity, is a judgment; while, in its turn, the fuller concept becomes an element in our later and more precise judgments.

Like every thing else, our judgment will have various degrees of perfection and imperfection. The most important quality of a judgment is clearness; the next, accuracy; while promptness, stability, and independence are all of considerable value. By a clear judgment we mean one in which the concepts or representations are distinct, and the relations between them distinctly understood. The judgment, 'Poetry is a criticism of life,' will be just so clear, and no more, as the concepts 'poetry,' 'criticism,' and 'life' are distinct, and as the mind clearly discerns the relation between 'poetry' and 'criticism of life' which is implied in the assertion, — how it is equivalent to certain verbally unlike statements, but incompatible with others. It is easy to see that want of proper observation is one of the commonest sources of indefiniteness. If the observation has been faulty, the concepts or representations will be faulty, and so will be our apprehension of the relation of the notions we wish to connect. Memory may play us false by recalling imperfect images, or by recalling them with all the life and reality of the relations between them departed; or feeling may come in, paralyzing our powers of discrimination, and misdirecting our decisions. We must not omit to note, moreover, the tendency that most of us have, and which is particularly strong in children, to accept the judg-

others, though we do not apprehend or meaning of what is asserted, and are hazy as to what the assertion concerns. ers are very liable to produce vagueness sion in this way. We impose our judg- our pupils; we are contented with their rance that 'they see;' we rush on from p, and then are astonished to find how muddled the children's views are. have even been known to grow quite with the children on this account, re- lay, and setting all the confusion down ul perversity on the child's own part. r qualities which characterize sound eable judgments need no particular re- e.

f our judgments are arrived at immedi- ntuitively, such as, 'This fire is warm,' y friend last week.' These are called ' judgments. But, on the other hand, that many of our assertions are reached ess of reasoning or inference. Just as ect two concepts or representations to dgment, so we may connect two or more s to form another judgment in advance Thus, from the assertions that 'all re elements' and 'iron is a metal,' we ve the judgment that 'iron is an ele- r we may infer that 'all material bodies ght,' because we have found that this y other material bodies have weight. ting judgment we term a 'conclusion,' judgments from which it is derived s.' To reason, then, is to pass from judgment or judgments to a new is implies that we recognize the relation the new and the old judgments; that we d the connecting link or similarity be- em. Reasoning is, in fact, as Mr. Sully "only a higher and more complex pro- ssimilation, identification, or classing." re difference we can infer nothing. If are both equal to $z$, we can infer that ut if $x$ and $y$ are both greater or less than not from these facts infer any thing as ation between $x$ and $y$. Again: in our the premises and the conclusion may particular. A boy may have noticed everal occasions when the wind was in his master was cross, and he may infer, wind being in the east to-day, his master ross. Or the premises may both, or one be general, and the conclusion be either or particular; as when we reason, that eing a material body, and all material aving weight, therefore oxygen must ight: or that all gases have weight, because all gases are material bodies. The former is called implicit, the latter explicit, reasoning. But the distinction is not of great value to the logician, because we do, as a matter of fact, in implicit reasoning, tacitly assume a general premise: the boy in our example, consciously or unconsciously, assumes that *all* east winds make his master cross. There is another distinction, how- ever, which applies to reasoning, and which will be of great use to us. We may either argue up to a general truth from premises which are particular, or at least less general; or we may apply this gen- eral truth to cases which are less general or particu- lar. Thus, having found that gold and silver and copper, etc., are all elements, we may arrive at the conclusion that all metals are elements; or, seeing that all birds die, and all fishes die, etc., we may infer that all animals die. On the other hand, from the general truth that all the radii of a circle are equal, we may infer that two particu- lar straight lines, AB and AC, being the radii of the same circle, are equal to one another. In the former case, our reasoning is said to be inductive; in the latter, deductive.

The chief point to notice in induction is, that in general our conclusion goes beyond what our premises give us the right of asserting as actually true. We can never, therefore, be certain, in such cases, of arriving at absolute truth, but only at a greater or less degree of probability. When we assert that all planets move round the sun in the same direction, the 'all' includes more cases than are mentioned in the premises, — more cases than we have observed. Further experience may prove that some of our general conclusions are wrong. This has been the case with the emission theory of light, which has now been abandoned for the wave theory. Or, to quote a simpler case, Mr. Jevons mentions that Format maintained that $1+2^{2^x}$ always represents a prime number for all values of $x$; and so it does, till the product reaches the large number 4,294,967,297, which is divisible by 641. This danger should be a warn- ing to us in our use of inductive reasoning with children at school. We are all of us, young and old, far too much given to generalizing[1] from too few particulars, and to asserting that what has happened in a certain number of particular cases

[1] It will be well to note, in order to avoid confusion, how inductive reasoning, which is a kind of generalization, differs from the generalization of judgment. In each case we trace out a similarity among a number of different things. In judgment, we do so in things viewed as single and apart, in order to connect with one or all of them a general notion applicable to them all: in induction, it is the *relations* of things to one another to which we attend, and we seek to establish some connection between these relations, and thus to arrive at some wider relations between the things themselves.

will always happen in all like cases. This is a habit, or a tendency, not to be encouraged, but to be corrected. The experience of children can never be very great, — never sufficient for a very wide generalization: and to allow them to draw conclusions from insufficient experience, however right our wider experience may have shown that conclusion to be, is to allow them to form a very bad habit indeed. Are we, then, to exclude inductive reasoning from the schoolroom? By no means. Inductions vary almost infinitely in their degrees of generalization, from the narrow inductions with which children themselves spontaneously begin, such as 'Flies die,' to the law of gravitation. Let us follow nature's hint, and restrict our pupils' work at first to the narrower kinds. We shall then be fairly safe, especially if we are careful, as we should be, to afford the young inquirer every possible opportunity of testing and correcting his conclusions. I need scarcely point out here that the inductions of mathematics will be at first even more useful to us than those of physical science. In mathematics the premises are so carefully restricted, and the applications of the conclusions so strictly narrowed, that within their assigned bounds our inductions are absolutely true; so much so, that Mill refused to regard them as real inductions at all. Moreover, we can test them exhaustively, — I will not say *exhaustingly*, — and so make perfectly clear their truth and value. In grammar also, especially in that of the mother-tongue, the inductions are simple and easily made, and the means for testing their accuracy are always ready to hand. Again, the way in which children earliest show their curiosity is in seeking for causes. They have a strong tendency to look upon every thing as having a cause and a purpose. Here, then, is another valuable hint of nature as to the kind of work we should choose. Many easy exercises of the kind we require are to be obtained from among the simpler phenomena of nature, or from mathematics, and even history. The discovery of causes is, however, often a very difficult process, and always implies a method of procedure. For a discussion and exposition of this, I must refer you to two excellent chapters in Mr. Jevons's little book (chapters xxviii. and xxix). For convenience sake, I shall quote here Mill's canons which bear on this matter, and which are to be found in the chapters referred to. The first is the rule for the method of agreement: "If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree is the cause (or effect) of the given phenomenon;" or, more briefly, the sole invariable antecedent of a phenomenon is probably its cause. The next refers to the method of difference. It runs: "If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former, the circumstance in which alone the two instances differ is the effect or the cause, or an indispensable part of the cause, of the phenomenon."[1] As Mr. Jevons remarks, this is essentially the great method of experiment, and its utility mainly depends upon the precaution of only varying one circumstance at a time, all other circumstances being maintained just as they were. Thomson and Tait remark (*Natural philosophy*, vol. i. p. 307), "In all cases when a particular agent or cause is to be studied, experiments should be arranged in such a way as to lead, if possible, to results depending on it alone; or, if this cannot be done, they should be arranged in such a way as to increase the effects due to the cause to be studied till these so far exceed the unavoidable concomitants that the latter may be considered as only disturbing, not essentially modifying, the effects of the principal agent." The next canon refers to a joint method of agreement and difference: "If two or more instances in which the phenomenon occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance, the circumstance in which alone the two sets of instances (always or invariably) differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon." The next canon relates to what may be called the method of concomitant variations: "Whatever phenomenon varies in any manner, whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation." Lastly, I will quote the canon relating to what Mill called the method of residues: "Subduct from any phenomenon such part as is known by previous inductions to be the effect of certain antecedents, and the residue of the phenomenon is the effect of the remaining antecedents." Those who desire more than Mr. Jevons gives, may find it in Mill's 'System of logic' (book iii. chapters 8, 9, 10).

[1] So, when we are trying experiments on condensation, — of steam, for instance, — we find that a plate held in the steam condenses some of it. What causes this? Perhaps the coldness of the plate's surface. Well, then, let us heat the plate and try: result, no condensation. Let us make the plate very cold by placing it for a little while in the freezing mixture. What is the result now? Increased condensation. Probably, then, cold produces condensation. And so on, through a number of other experiments.

By the processes I have described above, the child reaches a large number of general or universal judgments. To these are added all the general statements made to him by others in the course of instruction. These he can now apply to the explanation of particular or less general cases, as has been already shown; that is, he can make use of deduction. The logical forms of this kind of reasoning are: "All soldiers have to fight; John is a soldier, therefore John has to fight;" or, "No mistakes deserve praise; this is a mistake, therefore this does not deserve praise." But though this is the logical, it is seldom if ever the psychological order of inference. As Mr. Sully points out, "in some cases the conclusion first presents itself to the mind, and the other judgments rise into distinct consciousness later; and in other cases the mind does not at any stage distinctly represent more than one of the two truths making up the premises." Again: besides starting with a general truth and seeking to make applications of it, we may also start with some particular statement or fact, and then seek among the general truths already acquired for that under which it may be brought. In our language work we may have an instance of a noun in the genitive, and we seek to find what rule for the genitive will explain our instance. Or in our geometry work we may have a theorem given us to prove: we assume it to be true, and then seek to attach it to some known and already proved theorem, and then, finally, reverse our work to produce the proof required. This last is the usual way in which children explain things to themselves and others. "Why am I blamed for having done this? Because what I did was called, or was, cruel, and acts called cruel deserve blame," is the clear statement of the reasoning which, more or less confusedly, will pass through the mind of a child. In connection with this, we should note the method by which all our greatest discoveries concerning the laws of nature have been made. The examination of a certain number of particular cases suggests a general principle (or more than one) under which they may be brought. We assume the general principle to be true, and deduce the results for several particular instances. We then compare these results with the results of actual observation in the same cases. If the latter confirm the former, we accept the general principle as true — at any rate, for the time being; if they do not, we either modify our assumption or try another. It was in this way that Newton and Faraday, and numberless others, worked, and that all men of science are now working. It was in this way that the great theory of the conservation of energy was discovered, and which was verified so admirably by Mr. Joule's experiments. In this, as in nearly all our complex reasoning, you will observe that induction and deduction are mixed; the former suggesting general truths, and the latter deriving conclusions from them. Both these two kinds of reasoning are liable, of course, to error. Both depend on observation, reproduction, imagination; both are processes based on the detection of similarity. If these are faulty, our conclusions will be fallacies. Especially in the case of deduction is a mistaken idea of similarity, or the want of discrimination, a fruitful source of error; the ambiguity, or want of clearness, in the terms employed being also most frequently a great cause of our going astray. Attention as regards all that is employed in our argument, and concentration as regards the special object of our search, will also be necessary parts of our outfit.

As Mr. Sully has pointed out, the powers of judging and reasoning show themselves later than the power of conception. At quite an early age, children will form rudimentary notions of things, and will even go as far as the formation of implicit judgments; but they will not yet be able to form explicit judgments. The order of development appears to be as follows: 1°. Implicit judgments, — the results of observation and memory, involving no inference; 2°. Explicit judgments, involving inference, about individual things, consisting of statements about actual facts then present; 3°. Judgments concerning striking attributes, later with reasons; 4°. Judgments involving consciousness of alternatives, introducing 'no' and 'not:' 5°. Judgments concerning classes, the predicates becoming gradually more general and more abstract; 6°. The curbing of exaggerations and mis-statements, — less tendency to treat fancies as realities, — criticism of the statements of others, or increase of independence. The development of reasoning follows very similar stages: 1°. Reasoning from particulars to particulars; 2°. Then seeking for causes, with the familiar 'why:' 3°. Deductive reasoning, consisting of the application of simple rules to simple particular cases, then to cases requiring a more intimate understanding of the rule, then the application of rules less simple; 4°. Somewhat later will come inductive reasoning, with ever-increasing power of abstraction; 5°. Lastly, complex reasoning and chains of demonstration.

For convenience, let me recapitulate the points on which clear judgment and clear reasoning depend. Clear judgments depend on clear conceptions and representations, and on the clear understanding of the connection stated and the terms

employed, and also on keeping the emotions under due control. Judgments should be clear, accurate, prompt, stable, independent. Clear and sound reasoning depends on clear and sound judgments; on the clear understanding of the relations between judgments and the terms employed; and on clear attention and imagination (involving discrimination), which keep vividly present the relations of the ideas and the objects with which we are concerned. Fallacies arise mainly from mistaken ideas of identity or similarity.

Here I should like to quote the whole of Mr. Sully's section on the training of the powers of judgment and reasoning, the subject is so difficult, and what he says is so clear and sound. Children, as we know, delight in exaggeration: nothing is so attractive to them as vividness and picturesqueness of statement. Their fancies are active. Their curiosity, except as to what directly helps fancy, is fluctuating and easily satisfied. The anthropomorphic nature of many of their views about nature is startling to those who have forgotten their own childood. To step in, and seek to repress and change and destroy all this, is to act in distinct opposition to the teaching of nature, — a proceeding which some teachers already recognize as ill-advised and unsafe. Surely a teacher who would destroy a child's delight in fairyland, or its happy belief that its pet dog understood every thing said to it, and the like unjustifiable ideas, would deserve a punishment but little less than that of old inflicted on traitors. Again: unless the child himself forms the judgments and does the reasoning, there is no exercise of his faculties, and therefore no development. But his experience is very small, and his conclusions can seldom be justifiable, even when correct. It cannot be right to encourage him to generalize from insufficient data, and to reason without clear discrimination. In the face of these difficulties, I should advise that we be not in too great a hurry to give a systematic training to the reasoning faculty. The eleventh or twelfth year would be quite early enough, I think, to begin. Meanwhile there is much work to be done in exercising the senses, attention, memory, imagination, and conception; while the exercise of judgment, which the later stages of this work will introduce, will be quite enough, at first, for our needs. By all means, let us encourage the child's curiosity by affording him the means of feeding and satisfying it. If rightly treated, it will grow by what it feeds upon. When the child cannot, of himself, attain to the knowledge requisite, let us, using a wise discretion, give him an explanation such as he can understand. In this way we shall not interfere with his fancies, though they, in some cases, when too vagrant and emotional, must be gently checked. Difference in the temperament of children should make a difference in their treatment. "But" — and here Mr. Sully speaks — "the training of the reasoning powers includes more than the answering of the spontaneous questionings of children. The learners must be questioned, in their turn, as to the causes of what happens about them. A child cannot be too soon familiarized with the truth that every thing has its cause and its explanation. The mother, or teacher, should aim at fixing a habit of inquiry in the young mind, by repeatedly directing his attention to occurrences, and encouraging him to find out how they take place. He must be induced to go back to his past experiences, to search for analogies, in order to explain the new event. The systematic training of the reasoning-powers must aim at avoiding the errors incident to the processes of induction and deduction. Thus, children must be warned against hasty induction, against taking a mere accidental accompaniment for a condition or cause, against overlooking this plurality of causes. This systematic guidance of the child's inductive processes will be much better carried on by one who has studied the rules of inductive logic. In like manner the teacher should seek to direct the young reasoner in drawing conclusions from principles, by pointing out to him the limits of a rule, by helping him to distinguish between cases that do, and those that do not, fall under it, and by familiarizing him with the dangers that lurk in ambiguous language; and here some of the rules of deductive logic will be found useful." Finally, the best subject-matter on which to exercise the child at first will be that connected with common every-day knowledge. Speaking broadly, physical science will best supply us with inductive exercises, and mathematics with deductive exercises. In some subjects of the former, such as botany, chemistry, and physiology, his work will be almost wholly inductive: in some of the latter, such as arithmetic and algebra, his work will be almost wholly deductive.

H. COURTHOPE BOWEN.

## THE NATURAL METHOD OF TEACHING LANGUAGES.

THE article on "The 'natural method' of language-teaching," in *Science and education* for Dec. 24, closes with the remark that conservatism is not always to be decried, and all innovation is not necessarily good. This thought is so correct that nobody could justly object to it; and, if all other observations made by the opponents of the natural method be of equal soundness, the cause of this

much-discussed method would not seem to be as good as its friends might desire. What evokes, however, the reader's doubt at first, is the high praise lavished upon the old method, with its two mighty cornerstones, — the grammar-book and dictionary. One will naturally ask, If the old and long-established method is really as efficient as its defenders would have us believe, why is it, then, that discontent could arise against it, spreading to the great dimensions of to-day? Why is it that just the graduates of our colleges, who have had the full benefit of the blessings of the old method, speak frequently, with a very significant smile, of their knowledge of modern languages acquired in their *alma mater?* Why is it that men of high standing are protesting against that mode of studying which is in vogue in so many of our colleges and schools?[1] And why is it that the old method, being so strong and good as is claimed, could be shaken in its very foundation to such a degree that one of its warmest defenders writes but lately,[2] "It is evident to me that the old grammatical method cannot survive the assault of the natural method"?

On the other hand, if the principles of the natural method be as wrong as is said by some of the opponents, it would seem strange that scholars and teachers like Whitney, Thacher, and Hadley of Yale should have permitted their sons to be taught by the founder of the method; that a man like Prof. Dr. Daniel Sanders declares himself for the method;[3] that men throughout the country, prominent in their vocation, are favoring the natural method;[4] and that an educational journal which is not friendly inclined towards the method should have recently been forced to admit that "the subject is now attracting great attention in the secondary and higher schools."[5]

These discussions in educational and other papers furnish occasionally very interesting reading, and recall to one's mind a well-known story about three professors who were given the task to write the natural history of the camel. None of them had seen the animal, but they set to work at once in the following way: the first one retired to his charming study, and, trusting to his vivid imagination, wrote a history as he thought it ought to be; the second one was busy in the libraries, and, out of all the material collected from books written since the time of Julius Caesar, he gave a natural history of the camel; the third one alone had departed to the country, where he could see a camel and learn something about it, so that his report might be true to the facts. If it so happens that the reader of the discussions referred to is familiar with the working of the natural method, it will be hard to convince him that all who are passing judgment against it could ever have tried the method practically and earnestly, or could even have seen a complete course given.

The question has been raised, 'Is the natural method a method at all?' If it be correct that the term 'method' signifies 'a series of means purporting to lead to some desired end,' then the question must be answered in the affirmative. All the rules of the method pertain either to matter or to the individual.

First, it is required that one should proceed in the treatment of the language and in the treatment of the laws of language; i.e., grammar, in accordance with that method, which, ever since Bacon's time, has been the acknowledged method for true study, — the inductive method.

Second, it is required that the treatment of matter after the inductive method should vary as the individuals who are taught vary in age, character, ability, and preparation.

To fulfil these requirements to the best advantage, it was found necessary to establish the general rule that the language which is to be taught must serve exclusively as means of communication between teacher and learner.

There is nothing especially new in either of these requirements; in fact, one or the other of them has been successfully employed at various periods by different methods: but the united application of them has been first attempted by the natural method; and it is this united application that causes revolution in language-teaching. It is needless to repeat here that the credit of the innovation is due to Prof. Gottlieb Heness of New Haven, Conn. The special training in the principles of Pestalozzi, which he received in the Lehrer Seminar,[1] and peculiar experiences in the teaching of children, had led him to those conclusions with which we are now acquainted. To

[1] D. C. Gilman, president of Johns Hopkins university, writes thus to one of the advocates of the natural method, Aug. 15, 1878: "Many years ago Mr. George Ticknor, while professor of modern languages in Harvard, declared, that, although Americans spent as long a time as Germans in acquiring a liberal education, the results in this country were far inferior to those secured abroad. Other recent writers have illustrated the same point, and have shown how much our deficiencies as an educated people have been due to bad methods of teaching both ancient and modern languages."

[2] See *The academy* of December, 1886, p. 339.

[3] Referring to a certain set of readers prepared for the natural method, the celebrated German grammarian and lexicographer says to the writer of these lines, in a letter dated March 3, 1886, that the method followed therein has his full approval ("dass die darin befolgte Lehrweise meinen vollen Beifall findet").

[4] See *The natural method*, No. 6, vol. ii., January edition.

[5] See *The academy* of November, p. 301.

[1] A German institution in which young men are prepared who intend to teach in the public schools.

assume, however, that his method is merely a method for children, because some of his first experiments through which he arrived at certain principles were made in children's classes, is as erroneous as to believe the perusal of the various readers give an insight into the real character of the natural method. Let us now see if the method is capable, in certain measure, of satisfying the demands of the ideal method which the writer of the article in *Science and education* has outlined. The rational method, as he chooses to term the wished-for ideal method, "would take, wherever it find them, all pedagogical methods of undoubted value, and incorporate them in its instruction." This condition, I doubt not in the least, the natural method fulfils well. The writer himself says complainingly in his article, "Since they [that is, the claims of the most enthusiastic votaries of the natural method] were first formulated, the details of the system have grown by a not unnatural accretion, until they include a great mass of pedagogical material, some of which is about as much the especial property of the natural method as spectrum analysis is an individual prerogative of the pupils of Helmholtz. From one point of view, this is, perhaps, not to be deprecated; for, through the active proselytizing of its disciples, sound pedagogical principles have obtained a currency and found their way where otherwise they might not so easily have penetrated."

Then the rational method "would, above all, use the language taught at every possible opportunity, and make its practical acquisition the one end in view." Ever since the natural method has been brought to light, its advocates have preached and practised the rule of using the language taught at every possible opportunity; and some teachers have, in fact, acquired such a skill in using the language taught that they never will use any other while teaching; nor do they lose any more time while explaining or giving definitions than a teacher of the old method would by using English.

Third, according to a rational method, "the grammar and dictionary are effete in modern-language instruction if they are taught for themselves alone." I believe no one has as yet reproached the natural method for having ever taught grammar and dictionary 'for themselves alone.'

Fourth, a rational method would give the good advice, "Regard them [dictionary and grammar] as they should be regarded, as auxiliaries, and employ them in that way." During more than twenty years the advocates of the natural method have been teaching constantly this doctrine, which their opponents explained in their own way, accusing the method of neglecting the teaching of grammar, while the criticism justly should have been directed against the unthorough, unsystematical, go-as-you-please way of certain teachers they had met with. But, if they had been present for a single hour in a class conducted by the founder of the method, they would have had the opportunity of seeing grammar taught systematically, after the inductive method; and had they asked the question, "Why are the words 'without dictionary and grammar' printed on the titlepages of your books and pamphlets?" they would have received his answer: "If you call this [referring to his teaching the principles of the construction of the language] grammar, you are at liberty to tell the world that I teach grammar." And, indeed, critics should know this, once and forever: the natural method not only teaches grammar, but teaches it more thoroughly than possibly could be done by the old method.[1]

Fifth, the rational method "would have extracts furnished at the outset with a special vocabulary which would be learned." Almost every one of the many readers published already for the natural method gives a large supply of such extracts; and they are in some of the best of these readers so selected and arranged that the words must necessarily impress themselves on the student's mind without any memorizing at all.

Sixth, "later on" the rational method "would inculcate the use of the dictionary." The natural method is always ready to comply with this demand, though it must respectfully decline to take a text-book of grammar as a 'cornerstone;' and, in this view, it has on its side the opinions of learned men of various times.[2]

A great deal has been said of late about the

[1] See 'A plan for twenty-eight lessons for the class in French,' or 'Program of October, 1886,' both published by Stern's School of languages of New York City.

[2] "One can learn the grammar from the language, and not the language from the grammar." — JOHANN GOTTFRIED VON HERDER.

Prof. Rudolph Hildebrand, editor of the great German dictionary begun by Grimm, says in 'Vom deutschen Sprachunterricht in der Schule,' "Der Lehrer des Deutschen sollte nichts lehren was die Schüler selbst aus sich finden können."

"One should begin with the spoken language with sentences, and from the audible language one should proceed to written language. Reading must be considered as the centre of language-teaching, and in connection with it grammar must be taught inductively: the learner must be guided so as to find for himself the laws of language." — *Internationale Zeitschrift für allgemeine Sprachwissenschaft*, band ii. heft 1 (Leipzig).

"The language is not to be learned from the grammar, but from and through the language." — SCHRADER, vii. p. 241.

"The grammar must not precede, but follow." — GRAF VON PFEIL, in *Wie lernt man eine fremde Sprache*, p. 31.

name 'the natural method,' and of the success being due to that name. For those who lay so much stress on the name, it will be interesting to learn that neither the founder of the method, nor some of the most prominent exponents, had any thing to do with the giving of the name. One of Harvard's learned professors has done the method the honor to christen it; and a research after the true motives for selecting just that name, with all its meanings, is certainly a worthy subject for investigation. But to attribute the popularity of the method solely or mostly to its name, seems hardly to be reasonable. To my judgment, it is the truth of the method, the zeal and energy of its followers, and the much-felt need of better methods in general, which explain the conquering power of the natural method. SIGMON M. STERN.

## THE TRAINING OF TEACHERS.[1]

THE profound significance of the teacher's profession is not yet properly recognized. Many men, of considerable intelligence even, think that school education covers too narrow a field of life to have facts and principles capable of constituting a science, and that teachers of common schools are but day-laborers, having no professional standing, and hence needing no professional training. On this account, our normal schools will have many trials to meet, and many difficulties to overcome, before reaching the position towards which they are struggling.

As yet, our advanced high schools and colleges do not supply these schools with a sufficient number of students whose thorough literary attainments warrant a more exclusively professional course of studies. In fact, our normal schools are necessitated to do this preparatory academic work themselves. In this way they render themselves liable to the charge of being only academies with a quasi-professional annex.

We have all along very much regretted the necessity of directing so much attention to the academic training of the students in these schools, and have carefully studied how to keep the purely professional element from being too much neglected, without, at the same time, sacrificing the thorough literary instruction required.

The large supply of teachers required for the educational work of the state, and the very low average of salaries given for educational labor, make it almost impossible to lengthen very much the present term of study. Some, with great earnestness, have advocated the addition of another year. In due time this will come, and be of immense account in enlarging the sphere of professional studies, and giving opportunity for more definite and continuous model practice, which, when rightly conducted, is of so much value.

The literary instruction may have been given in harmony with the best principles which the present philosophy of school education is able to give, and in such form as to bring into view the very best methods which either the science or art of teaching furnishes. We are not calling this in question at all; but we must keep in mind that the students, at the very outset, are backward in their literary studies, and have but little knowledge of psychology. Hence they are forced to make every exertion in preparing for their daily class-work, and must be, of necessity, far more anxious about the matter of what is taught than about the manner or method of teaching it. They fear to spend any more time in the model school than is absolutely required by law. They make the minimum here the maximum, if they can. In addition to this, being subject at the close of the course to a rigid state examination, covering all the academic studies pursued, they, with their professors, are tempted to sacrifice all efforts towards enlarging the course of professional studies through fear of the issue of the final examination-test.

Although the course of studies as now arranged is not very satisfactory to us, and will need, in our judgment, some important changes, yet we have felt constrained to approve it on account of our great anxiety that the graduating year should be given more fully to the work of professional training, taking up the whole history and science of school-teaching, and illustrating in detail the psychological ground of every method by a greatly enlarged course of practice in the model school. Such practice, in our judgment, is very essential. Indeed, it sustains the same relation to the normal-school studies as a moot-court does to a law-school. Here theory finds verification; here principles pass into direct conscious application; here science makes its transition to art; here the furnished scholar learns to handle with vigor his whole armor, as a page when he became a belted knight and entered the tourney. The teacher needs scholarship, of course, but he needs something more: he must have knowledge, and, at the same time, thoroughly master the art of imparting it. To this end our normal schools were established; in this direction they steadily tend. In the above plan, however, no one thought for a moment of not holding with firm grasp the essential truth that professional knowledge cannot exclude schol-

[1] From the annual report of E. E. Higbee, superintendent of public instruction of the state of Pennsylvania.

arship. Evidently, he who knows not the subject to be taught can never be a master of the method of teaching it.

It is plain that all our teachers cannot have the benefit of a professional training in our state normal schools. The number is too great for us to expect this. It is important, therefore, that they use every opportunity within their reach to advance their professional zeal and skill. Well-conducted teachers' institutes are exceedingly valuable for this purpose; indeed, in our judgment, indispensable. It is not out of place here to mention in brief some of the benefits derived from these institutes. Teachers, especially in our country districts, are much isolated. They need the inspiration gained from association. Engrossed with their daily routine of labor, and deprived of all chance of any frequent consultation with others of their own vocation, their work is in danger of becoming a monotonous task, lacking all incitement to that professional zeal which prompts to new exertion and sweetens every toil. These yearly conventions serve, in a great measure, to keep up the *esprit de corps*, and to give rest and recreation so much needed and so valuable, while each teacher feels the support of, and enjoys communion with, the profession at large. Again, by means of the pointed instruction of experienced educators, many difficulties are removed, better methods suggested, troubling mistakes corrected, false tendencies thwarted, and new inspiration aroused. Through valuable lectures and addresses, educational interest is awakened, and the warm sympathy of large communities gained in behalf of the schools. Parents and teachers and directors come face to face, and the duties and responsibilities of each are more clearly understood. It would be a fatal mistake not to encourage these institutes in every possible way.

## LUDWIG WIESE.

IN his review of Wiese's *Lebenserinnerungen u. Amtserfahrungen*, published in the *Berliner philologische wochenschrift*, Professor Paulsen pays a warm tribute to Wiese's character and pedagogical work. He describes Wiese's life as that of a healthy, strong, enthusiastic, frank, and self-confident personality, and calls his life a rich and happy one in the true sense of the Aristotelian definition. Wiese was born at Herford in 1806, and from 1826 to 1829 studied theology and philology at the University of Berlin. His activity as a teacher began in the Friedrich-Wilhelms gymnasium, and in 1831 he was called as con-rector to the gymnasium at Clausthal. In 1837 he accepted an appointment at the celebrated Joachimthalisches Gymnasium, and worked there until he was appointed to an office in the ministry of education in 1852. Wiese's early teaching pointed out for him the demands of sound methods of instruction. He himself says, "The perception that the majority of the pupils understood the rules as laid down only with much difficulty, suggested to me to begin with the demonstration of an example, letting them discover the rule for themselves from it. Such examples as commended themselves as suitable for this process I brought together as *Normalsätze*, and, having dictated them to the pupils, caused them to be learned by heart; which was done willingly and easily. The result was surprising, and the written themes soon showed a pleasing correctness. It was the beginning of a grammar invented from examples." While a teacher at the Joachimthalisches Gymnasium, Wiese made a journey to Italy and one to England. The letters which he wrote home to a friend about the English educational establishments were published as 'German letters about English education.' In 1852 he was intrusted by Minister von Raumer with the supervision of the secondary school organization of Prussia, and for twenty-three years he held this office under four successive ministers of education. In 1875 the governmental policy of *Kulturkampf* brought about his resignation. The two aims of Wiese's official life were, first, the confining the curricula of the gymnasia within proper bounds; and, secondly, the restoration to the gymnasia of the former Christian character. Professor Paulsen's estimate of Wiese's influence is kindly but cautious, and it probably well represents the esteem in which the veteran educator is held in his native land.

## THE SIGNIFICANCE OF GEOGRAPHICAL NAMES.

THE importance of geographical names in connection with the teaching of history and philology is almost entirely overlooked by teachers. These subjects acquire an added interest if linked together in this way, and details are better retained in the memory if provided with these associations. The following account of the word 'Donau' is translated from the *Zeitschrift für das realschulwesen*, and serves as an example of how history, geography, and philology may be connected in teaching. The points of contact, and the lines in which they can be developed, are apparent.

The Greeks (Herodotus, ii. 33) applied the name 'Donau' (Greek, 'Istros;' Roman form, 'Ister' or 'Hister') to the entire stream, and used it almost exclusively, though their later authors

also knew of the the Celtic name, 'Danuvius,' which had become known to the Romans. The Greeks learned the name 'Istros' from the Thracians, and applied it as the general name for the river, from the point where the stream issued from the mountains as far as the Thracians occupied its banks. Yet it does not follow necessarily that the name 'Istros' is of Thracian origin, as it may have been used still earlier by the ancient Illyrians who inhabited that country. It is traceable, probably, to the Aryan root *sru* ('to flow'), from which is also derived the name 'Strymon.'

'Danubius' or 'Danuvius' is the Latinized form of the Slavic name, from which *don* is derived, and which in composition becomes *dan*. Anciently this Latinized name was only used for the middle part of the stream. The Slavic root *don* ('water, river') appears in the names of many other rivers: for example, Don, Dwina, Dniester, Dnieper, and so forth. In the 'Nibelungenlied' the Donau is called Tuonowe, that is, the river Tuon. To the name 'Don' the German *aha*, *aa* ('river'), is added, and in the sixteenth and seventeenth centuries the forms Dunaw, Tonaw, Donaw, first appear.

## THE STUDY OF BROWNING.

THERE can be no question that the picking-apart process to which, under the exigencies of instruction in grammar and parsing, Milton and Shakspeare, Addison and Macaulay, are alike subjected, is an evil. It may or may not be a necessary evil: if it is, its effect should be subsequently counteracted as far as possible; if it is not, it should be done away with. The pupil who is always on the lookout for inverted sentences, modifying clauses, and auxiliary verbs, cannot appreciate the literary beauty of an author; and so it seems to us that the elementary details of grammar and the exercises for parsing might profitably be based on something less lasting and beautiful than the classics of the language. These details to which we have reference must undoubtedly be mastered; but could they not be mastered from current literature, reserving the classics for models of style and diction, and for the cultivation of a refined literary taste and a sound literary judgment?

If this dissection of the classics is a necessary evil, then great care should be taken to follow it up in the higher grades with the reading of a series of authors, such as Chaucer, Spenser, Shakspeare, Milton, Hooker, Addison, Steele, Burke, Macaulay, Tennyson, Browning, and their fellows, not with a view to parsing them correctly, but with the endeavor to understand and appreciate them. Professor Corson has given us a book on his hero, which would serve excellently for the purpose we have indicated.

*An introduction to the study of Robert Browning's poetry.* By HIRAM CORSON, LL.D. Boston, *Heath*, 1886. 12°.

Mr. Browning has his critics, but few poets have been favored during their lifetime with so numerous and energetic a body of devoted students and admirers as he has, both in this country and in England. Of these, Professor Corson is among the most enthusiastic; and his personal work, and the interest excited by his lectures, have led to the formation of many of the Browning clubs now at work throughout the United States. In the present work, he has given students of English literature an example of what we referred to above as the real end to be gained by the study of a great poet or prose writer. We do not want to parse 'Paracelsus,' 'Andrea del Sarto,' and 'Rabbi Ben Ezra,' but we want to read them to discover the thoughts they convey and the feelings they portray: in other words, we want to study them as literature; and this is precisely what Professor Corson's book helps us to do. His admiration for Browning is well-nigh unbounded. For example: he says, "Robert Browning is in himself the completest fulfilment of this equipoise of the intellectual and the spiritual, possessing each in an exalted degree; and his poetry is an emphasized expression of his own personality, and a prophecy of the ultimate results of Christian civilization" (p. 31). "It was never truer of any author than it is true of Browning, that *Le style c'est l'homme;* and Browning's style is an expression of the panther-restlessness and panther-spring of his impassioned intellect. The musing spirit of a Wordsworth or a Tennyson he partakes not of" (p. 75). The criticism so often made, that Browning's style is involved and obscure, Professor Corson notices, and attempts to answer. He says that a truly original writer like Browning is always difficult to the uninitiated, and that the poet's favorite art-form is also somewhat of an obstacle to the beginner. This art-form is, of course, the 'dramatic or psychologic monologue,' which differs from the soliloquy, as Professor Johnson (quoted by the author in a footnote, p. 85) has pointed out, in supposing the presence of a silent second person to whom the arguments of the speaker are addressed. In addition to these characteristics and to his peculiar collocations of words, Professor Corson finds four peculiarities of Browning's diction which are by some readers held to render him obscure. These are, 1°, the suppression of the relative, whether nominative, accusative, or dative; 2°, the use of the infinitive without the preposition *to* in cases not warranted

by present usage; 3°, the use of the simple form of the past subjunctive derived from the Anglo-Saxon inflectional form and identical with that of the past indicative, instead of the modern analytic form; 4°, the use of the dative or indirect object without *to* or *for*. But Professor Corson hesitates to condemn even these: he thinks that "they often impart a crispness to the expressions in which they occur" (p. 81). At all events, they render Browning's thoughts less accessible to the general reader than they might otherwise be. Professor Corson's essays on the idea of personality, and of art as an intermediate agency of personality in Browning, on Browning's obscurity and his verse, and his analytic arguments of the poems that are appended, are very suggestive, and will repay not only reading, but study.

## *COMPAYRÉ'S ELEMENTARY PSYCHOLOGY.*

M. COMPAYRÉ is so well known to students of pedagogy, and Professor Payne's translation of his 'History of pedagogy' has had so favorable a reception in this country, that his present book on psychology, and that on ethics, promised in March, will attract considerable attention.

In the little book now before us, the author, with the skill and lucidity of a true Frenchman, sketches the main topics of elementary psychology. M. Compayré begins by expounding in a few brief paragraphs the character and utility of psychology, and its relations to ethics, pedagogics, history, grammar, and literature. In speaking of the method of psychology, he mentions the distinction, so generally overlooked, between the scientific study of psychology and the elementary teaching of it. M. Compayré remarks that we do not confuse an historian and a teacher of history, and complains that authors of text-books of psychology should preserve a similar distinction in their science (p. 11).

In touching on the relations of psychological to physiological facts, he finds three points of difference between them (pp. 32, 33). First, the two categories of phenomena are not known in the same way. Second, the physiological phenomena are material movements: the psychological phenomena are something else than material movements. Third, the two sets of phenomena are in a certain sense independent of each other.

Then, accepting the usual classification of mental phenomena into those of knowledge, feeling, and will, M. Compayré enters upon the discussion of each. We can best represent his positions by quoting some brief passages dealing with controverted points in psychology: "De plus en plus, le mot âme est devenu synonyme de *principe spirituel*, qui sent, qui pense et qui veut" (p. 39); "La sensibilité, sous toutes ses formes, peut être définie *la faculté d'éprouver du plaisir et de la peine, et par conséquent d'aimer et de haïr*" (p. 55); "Ces principes constituent ce qu'on appelle la *raison*, c'est-à-dire tout ce qui est inné à l'intelligence, par opposition à l'*expérience*, c'est-à-dire à tout ce qui est acquis" (p. 74); "La *raison*, au sens psychologique, est l'ensemble des notions et des vérités qui ne dérivent ni de l'expérience ni des combinaisons de l'expérience" (p. 189); "Les vérités de la raison sont innées en ce sens qu'elles préexistent à l'expérience comme autant de dispositions naturelles; mais l'expérience est nécessaire pour les developper et les déterminer" (p. 191).

The value of the work as an elementary text-book is enhanced by the brief *résumés* given of each chapter, and by a lexicon of proper names and technical terms used in the book. Should the book be translated into English, as we understand is contemplated, it would be a decided addition to our elementary works on psychology.

*Notions élémentaires de psychologie.* Par GABRIEL COMPAYRÉ. Paris, *Delaploue*, 1887. 16°.

## *PAYNE'S CONTRIBUTIONS TO THE SCIENCE OF EDUCATION.*

PROFESSOR PAYNE'S volume of essays might, we suppose, following Max Müller's precedent, be entitled 'Chips from a Michigan workshop.' They are very plainly the results of the thinking done by the author on the educational problems suggested by his daily work. The first question we are tempted to ask is, Will they do any good? It must be remembered that a volume of this sort reaches a class of readers who are already more or less imbued with the author's views. It comes to them as a word of cheer and encouragement. But we should like to hear that Professor Payne's essays were reaching the indolent, untrained teacher, who believes that general information — and not too much of that — is the only preparation necessary for the teacher; and the loquacious and sarcastic sceptic, who has no trouble at all in proving — to his own satisfaction — the theorem that there is and can be no such thing as a science of education. We do not mean to say that Professor Payne's book would thoroughly arouse and convert such readers, for it is a trifle heavy, and conspicuously lacking in a certain attractiveness in style and arrangement that goes far to make a book successful; but it certainly would open up unknown regions to them, and stimulate further thought and inquiry. With the question, Is there

*Contributions to the science of education.* By WILLIAM H. PAYNE, A.M. New York, *Harper*, 1886. 12°.

a science of pedagogics? the author grapples at the outset; and while he reaches an affirmative answer, which we believe to be the proper one, he does so in a ponderous and not very direct manner. The following chapters, some of the titles of which are 'The science of education, its nature, its method, and some of its problems,' 'Contribution to the science of education values,' 'The mode of educational progress,' 'The potency of ideas and ideals,' 'Lessons from the history of education,' 'The secularization of the school,' 'Teaching as a trade and as a profession,' 'Education as a university study,' 'The institute and the reading-circle,' offer us excellent samples of what the scope of pedagogics is; for its points of tangency with psychology, ethics, and history, as well as the fact that it includes both theory and practice, are all indicated. Professor Payne says so much and on so many subjects, that we can best give an idea of his thought and method of treatment by letting him speak for himself. For example: in protesting against the erection of infant psychology, and therefore infant education, into a science apart, he says:—

"I am very far from denying that there are differences between a child's mind and a man's mind; but I insist that these are differences in *degree* or *power*, and not in constitution. It is freely admitted that these differences in power should be observed and heeded, and that mothers and nurses may do some real service by their registration of the phenomena of infant life. What I protest against is the present tendency to exaggerate these differences, and to assume that the child's education must be considered quite apart, as though he were a being *sui generis*. I venture to express the belief that one of the most serious errors in primary teaching arises from an exaggerated notion of the differences between child mind and mature mind. Some observed difference furnishes the devoted enthusiast with a clew; and then this clew is followed up so persistently, and so far, that one section of the child's mind is aroused to preternatural activity, while another section lies unused and torpid. It is observed, for example, that the sense activities predominate in childhood. The teacher lays hold of this clew, and there is such a persistent and copious feeding of the senses, that the physical section of the child's mind becomes abnormally active, and the intellectual section as abnormally inactive. It would seem to me a great gain if there were to be a return towards the older conception that the child and the man are essentially one, and that for infancy, childhood, and youth, there should be considerable sameness in instruction" (p. 19).

"The accomplished teacher should be a man of science in the sense that the accomplished physician is a man of science. I am persuaded that the motive which most attracts minds of the higher order into certain vocations is the opportunity for the free exercise of tact, talent, ingenuity, invention, discovery, and all the resources of a well-stored and well-disciplined mind. Minds of the better order love to take chances, to run risks, to anticipate the new, and to compass by sagacity some victory over danger and difficulty. To all such minds, the possibility of achievement is an inspiring motive of the highest order" (p. 291).

"The manifest tendency of the times is towards the secularization of the school. The modern state has become an educator, and relegates religious instruction to the family and the church" (p. 216).

Lack of space forbids our quoting further, but we recommend Professor Payne's book to all who can appreciate earnest thought on educational subjects.

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## *DAS VOLKSSCHULWESEN IM PREUSSISCHEN STAATE.*

IF the three large volumes of the compilation of Schneider and von Bremen, of which the first is before us, are provided with a good index, they will be invaluable for the student of the Prussian educational system and its development. If the index should be wanting, or not thoroughly made, the immense amount of material contained in the volumes will be effectually buried. The first volume is a large octavo of nearly a thousand pages, and contains the official regulations regarding "die Stellung der Behörden und Beamten, die Ausbildung und die Stellung des Lehrers;" and it is safe to say, basing the assertion on such an examination as we have made of the book, that not a single point is left untouched. The second volume will treat of "die Organisation und Verwaltung der Schulgemeinde;" and the third, of "die Schulpflicht, der Privatunterricht, die Schulzucht, der Unterricht in den verschiedenen Volksschulen." Our information about the secondary schools and universities of Germany is usually more full and explicit than that concerning the popular schools; but, with this work of reference at hand, we need no longer be in ignorance of the minutest detail concerning the latter. It must be borne in mind, too, that the official organ of the ministry of public instruction in Prussia, the *Centralblatt für die gesammte Unterrichtsverwaltung im Preussen*, is in

*Das Volksschulwesen im preussischen Staate, in Systematischer Zusammenstellung der Gesetze und Verordnungen, etc.* Compiled by Dr. K. SCHNEIDER und C. VON BREMEN. Berlin, *Hertz*, 1886. 8°.

its twenty-seventh year of publication, and that it is difficult, if not impossible, to procure the earlier volumes. The present work, by reason of its having used the material of the *Centralblatt*, serves as a substitute for the first twenty-six volumes of the latter, and is therefore especially to be recommended to libraries which have not a set of the *Centralblatt*.

The school-laws are here codified according to their place in the system, and not chronologically, which is an undoubted gain, especially to the foreign reader; and, as the dates of the various laws are always appended, nothing is lost by the change. As is the case with most compilations of this character, we are obliged to read a great deal that we care nothing about in order to reach the data of which we may be in search. But we should be willing to put up even with German prolixity and minuteness in order to gain so indispensable a work of reference as this is.

## DAWSON'S ZOÖLOGY.

ONE dislikes to severely criticise a book bearing on its titlepage such a widely and justly honored name as that of Sir J. W. Dawson, and yet it is difficult to see what good purpose is to be served by this work. The author sets forth his object as, "to furnish to students, collectors, and summer tourists in Canada, an outline of the classification of the animal kingdom, with examples taken, as far as possible, from species found in this country." From the footnote on p. 6, it would also seem that it is intended as a text-book. Eighteen small pages are devoted to a consideration of the animal tissues and functions, twelve more to the subject of classification in general, and the remainder of the book to 'descriptive zoölogy.' As may be inferred, the account of the tissues, etc., is very inadequate; and such a statement as that protoplasm is albumen (p. 6.) does not tend to give confidence in the accuracy of the work. There is not a satisfactory account given of the structure of any single animal or group: the most important thing to be learned of an animal would seem to be its name, and the name and definition of the group to which it belongs. Nor are the views of classification, in some cases, such as will find general acceptance among naturalists.

As a text-book, this work will not, we fear, prove satisfactory; the amateur will not find it easy to identify his collections by its aid; and, while there may be in it "many facts derived from original observation, and not otherwise accessible," it is not likely to become a valuable help to the specialist.

The illustrations are in most cases badly executed and sometimes misleading.

*Handbook of zoölogy.* By Sir J. W. DAWSON. Montreal, *Dawson Bros.*, 1886.

DR. WASHINGTON MATTHEWS, surgeon in the U. S. army, has made a valuable contribution on the causes which are at work in carrying off the Indians of our country. One of the most important of these he finds to be consumption. From the census of 1880 we learn, that, while the death-rate among Europeans is 17.74 per thousand, and that among Africans 17.28, the rate among the Indians is no less than 23.6. In diarrhoeal diseases the Indian death-rate is not greatly in excess of that of the other classes. Measles gives a mortality of 61.78 per thousand. But it is under the head of consumption that the difference between the Indians and the blacks is most conspicuous; the rate among the former being 286 as compared with 186 among the latter, while among the whites it is but 166 in the thousand. Dr. Matthews finds, that, where the Indians have been longest under civilizing influences, the consumption-rate is the highest; meaning by the term 'consumption-rate' the number of deaths from consumption in a thousand deaths from all known causes. Thus the rate among reservation Indians in Nevada is 45; in Dakota, 200; in Michigan, 333; and in New York, 625. The evidence appears to show that consumption increases among Indians under the influence of civilization, — i.e., under a compulsory endeavor to accustom themselves to the food and the habits of an alien and more advanced race, — and that climate is no calculable factor of this increase. It is a general supposition on the frontier that it is change of diet which is the most potent remote cause of consumption among the Indians. Dr. Matthews says he once knew of a previously healthy Indian camp of about two thousand people, where, in one winter, when the buffalo left their country, and they subsisted on flour and bacon furnished by the government, the majority were attacked by scurvy, and about seventy died of the disease. It is, however, also ascertained that the consumption-rate is high at agencies where the supply of beef is liberal, and, as has already been said, especially high among the Indians of New York and Michigan, whose diet is by no means a restricted one. It is evident that the true explanation for this remarkable predisposition of the red-man to pulmonary tuberculosis has not yet been given, and that a fruitful field is open to those whose qualifications and tastes lead them into such investigations as these.

## Contents of foreign educational periodicals.

*Pädagogisches archiv*, Dec. 8. — Bericht über die abteilung für naturwissenschaftlichen unterricht auf der 59. Versammlung deutscher naturforscher und ärzte in Berlin, 1886. — Die neueren philologischen bestrebungen der Franzosen, Dr. L. Schmidt. — Konstituirende versammlung zur begründung eines 'Deutschen einheitsschulvereins' zu Hannover, Dr. L. Viereck. — Beurteilungen, anzeigen, u.s.w.

*Zeitschrift für schul-geographie*, December. — Das geographische museum am Mariahilfer Gymnasium in Wien. — Ein tellurium mit elliptischer erdbahn und ein neues planetarium, Dr. Adolf Dronke. — Der geographische leitfaden. — Beitrag zu einer morphologie des Kosmos, H. Habenicht. — Der Mittelrhein und sein Vulcangebiet. — Notizen, u.s.w.

*Canada educational monthly*, January. — Notes upon habits, Prof. M. Macvicar. — Annual convocation of Queen's university, N. F. Dupuis. — Prose poems. — The curriculum of a French lycée, W. H. Fraser. — Notes for teachers. — Correspondence, etc.

*Educational times*, January. — On matter and force: nomenclature and methods of elementary dynamics. — Meeting of the Council of the college of preceptors. — Education in India. — University and college intelligence. — Educational progress of the past half-century. — Changes in the head-masterships of the great public schools during the past year. — Rugby under Dr. Jex-Blake. — The Harvard celebration. — Report of the teachers' training syndicate at Cambridge. — Reviews, notices, etc.

*Journal of education*, January. — Occasional notes. — English literature in public schools. — The conference of head masters. — Dr. Jowett on Boswell's 'Johnson.' — Reviews. — Women and culture, Mrs. William Grey. — A fair field and no favor. — Correspondence. — The teachers' guild of Great Britain and Ireland. — Notices of books. — Foreign notes. — Schools and universities. — Our translation prize. — The training of the faculties of judgment and reasoning (concluded). — Education in Australia (concluded). — Geographical exhibition and conference at Bradford.

## Educational articles in miscellaneous periodicals.

Bert's science in politics. Madame Adam. *Contemporary review*, January.

Contemporary philosophy in France. Unsigned. *New Princeton review*, January.

Délégation française aux Etats-Unis; notes de voyage. Charles Bigot. *Revue politique et littéraire*, Dec. 11 and 18.

Earthquakes. Archibald Geikie. *Good words*, January.

Education intellectuelle, l'. Paul Lafitte. *Revue politique et littéraire*, Dec. 18.

Evolution of language. Unsigned. *Knowledge*, January.

Faculté de médecine de Paris en 1885–86, la. M. Béclard. *Revue scientifique*, Dec. 18.

Géologie et la géographie, la. M. Charles Vélain. *Revue scientifique*, Dec. 18.

How I was educated. James B. Angell. *Forum*, January.

Industrial education in America. W. Odell. *Nature*, Dec. 2.
[A notice of the government document on this subject, prepared by Mr. J. E. Clarke.]

Lowell on education. Unsigned. *New Princeton review*, January.

Lower education of women, the. Helen M'Kerlie. *Contemporary review*, January.

Mathematical tripos, the. J. W. L. Glaisher. *Nature*, Dec. 2.

Origin of comets and meteors. Richard A. Proctor. *Knowledge*, January.

Origines de la Bible, les. Ernest Renan. *Revue des deux Mondes*, Dec. 1.

Origines de la chimie, les: métaux et minéraux de l'antique Chaldée. M. Berthelot. *Revue scientifique*, Dec. 11.

Péril alcoolique, le. J. S. Morand. *Nouvelle revue*, Dec. 15.

Possible limitations of the elective system, II. Prof. George H. Palmer. *Andover review*, January.
[This article closes the discussion as to the extent and merits of the elective system, introduced by Professor Palmer a year ago.]

Present position of philosophy in Britain, the. Henry Calderwood. *New Princeton review*, January.

Religion in the public schools. Archibald Alexander Hodge. *New Princeton review*, January.

Science in Norway. Unsigned. *Nature*, Dec. 9.

Science notes. W. Mattieu Williams. *Gentleman's magazine*, January.

Travail psychique et la force chimique, le. Charles Richet. *Revue scientifique*, Dec. 18.

Ueber die Wahrscheinlichkeitsrechnung u. deren anwendung auf die statistik. W. Lexis. *Jahrbücher für Nationalökonomie u. Statistik*, Nov. 13.

University education in the United States. Charles K. Adams. *Contemporary review*, January.

## Publications received at Editor's Office, Jan. 10-15.

ANDREWS, T. Effect of temperature on the strength of railway axles. London, Inst. civ. eng. 33 p. 12°.

BARROWS, Isabel C., *ed.* Proceedings of the national conference of charities and correction, at the thirteenth annual session held in St. Paul, Minn., July 15–22, 1886. Boston, G. H. Ellis. 12+457 p. 8°.

BELROSE, Louis, Jr. To the poet-laureate. Washington, Brentano. 4 p. 16°.

BRIFFAULT, F. Constantinople water-works. London, Inst. civ. eng. 11 p. 12°.

CLARK, J. S. A practical rhetoric for instruction in English composition and revision in colleges and intermediate schools. New York, Holt. 381 p. 12°.

COWAN, D. The Carron iron works. Scotland. London, Inst. civ. eng. 15 p. 12°.

ENDE, M. am. Formulas for the weights of girder bridges. London, Inst. civ. eng. 8 p. 12°.

FÖRSTER, M. von. Compressed gun cotton for military use. Tr. by J. P. Wisser, with introduction on modern gun cotton. New York, Van Nostrand. 164 p. 24°. 50 cents.

GRUENEWALD, J. R. Description of the viaduct over the river Retiro. London, Inst. civ. eng. 4 p. 12°.

HUNTER, G. M. Locomotive engine- and carriage-sheds as used on the Caledonian railway. London, Inst. civ. eng. 13 p. 12°.

KING, M. Harvard and its surroundings. 7th ed. Boston, Rand Avery company. 102 p. 16°.

MARTIN and WETZLER. The electric motor and its applications. New York, Johnston. 208 p. f°. $3.

MASSACHUSETTS fish and game commissioners, report of, for year ending Dec. 31, 1886. (Pub. doc. No. 25.) Boston, State. 91 p. 8°.

PHILBRICK, P. H. Beams and girders. New York, Van Nostrand. 159 p. 24°. 50 cents.

SCHWATKA, F. Report of a military reconnaissance in Alaska, made in 1883. Washington, Government. 121 p. 8°.

SECULAR thought. Vol. i. No. 1. Toronto, Charles Watts. $2.

U. S. NAVAL academy, Annapolis, Md., annual register of, 1885-86. Washington, Government. 70 p. 8°.

U. S. NAVAL advisory board, report of, on mild steel. Washington, Government. 216 p. 8°.
—— department. Annual report of the hydrographer to the bureau of navigation for the year ending June 30, 1886. Washington, Government. 51 p. 8°.
U. S. SENATE. Report of the select committee on ordnance and war ships, with appendix. Washington, Government. 512 p. 8°.
WHITNEY, W. D. Practical French grammar. New York, Holt. 442 p. 12°.

## Calendar of Societies.

*Philosophical society, Washington.*

*Jan.* 15. — G. K. Gilbert, The graphic method in research; C. D. Walcott, Geologic age of the lowest formation of Emmons's Taconic system; H. A. Hazen, The sky glows of 1883; H. A. Hazen, Lunar atmospheric tides.

*Jan.* 22. — F. W. Clarke, Present status of mineralogy; R. T. Hill, The topography and geology of the cross timbers of Texas.

*Chemical society, Washington.*

*Jan.* 13, *election of officers for* 1887. — President, Prof. E. I. Fristoe; vice-presidents, Prof. F. W. Clarke and Dr. J. H. Kidder; treasurer, Prof. William H. Seaman; secretary, Dr. A. C. Peale; members at large of executive committee, Mr. Edgar Richards, Prof. H. W. Wiley, Mr. J. S. Diller, Prof. Thomas Robinson.

W. H. Seaman, Models of molecular structure.

*Biological society, Washington.*

*Jan.* 22. — G. Brown Goode, The beginnings of natural history in America: the third century.

*Natural science association, Staten Island.*

*Jan.* 8. — Mr. Gratacap, Drift fossils of Staten Island; W. T. Davis, Short account of two interesting insects from the island.

*Torrey botanical club, New York.*

*Jan.* 11. — Dr. Britton, Curtis's latest fascicle of southern plants; H. H. Reesby, Botanical notes from South America.

*Annual meeting, election of officers.* — President, Dr. J. S. Newberry; vice-president, Thomas Hogg; treasurer, F. J. H. Merrill; recording secretary, Arthur Hollick; corresponding secretary, Miss H. C. Gaskin; curator, Miss M. O. Steele; librarian, Dr. N. L. Britton; editor, Elizabeth G. Britton; associate editors, F. J. H. Merrill, Jos. Schrenk, H. H. Reesby, C. H. Kain.

*Connecticut academy of arts and sciences.*

*Jan.* 19. — J. W. Fewkes, Is the vast mass of oceanic water, between the surface and bottom, barren of life, or occupied by a peculiar fauna?

*New England meteorological society, Boston.*

*Jan.* 18. — G. L. Goodale, Some supposed relations between forests and atmospheric ozone; F. V. Pike, Comparisons of rain-gauges at Newburyport; W. M. Davis, Winter temperatures about Mount Washington.

*Society of arts, Boston.*

*Jan.* 20. — Edward Burgess, The evolution of the modern yacht.

*Society of natural history, Boston.*

*Jan.* 19. — J. S. Kingsley, Arthropod development.

SCIENCE.

FRIDAY, JANUARY 28, 1887.

## COMMENT AND CRITICISM.

THE DEATH OF General Hazen, chief signal officer of the army, marks the close of the second period of the development of our weather-bureau. During the ten years from 1870 to 1880, while the bureau was under the direction of its first chief, General Myer, the labor expended upon it was given in greatest part to its organization. Stations had to be selected and their instrumental outfit determined; the time and kind of observations had to be decided upon, and observers instructed in their duties; the methods of reduction of data to practical form for use on a weather-map had to be adapted to the needs of a larger area than was ever before brought under the control of a single weather-office. Apart from the almost exclusively military constitution of the service during these years, its most marked characteristics in contrast with the European weather-services were the large sums of public money devoted to its support, the system of tridaily observations, and the absolute control exercised over all telegraphic lines in the collection of reports, in virtue of the law of 1866. Its maps were thus prepared more frequently and more promptly than weather-maps are abroad, and were admired all over the world.

General Hazen took charge of a highly developed service, and turned his efforts in two directions that to most persons appeared quite contradictory. He insisted on the need of military organization, and at the same time introduced numerous and important improvements that had nothing military about them. But during his administration, public discussion was frequently turned to the advisability of 'civilizing' the weather-bureau, for its work was not as successful as was desired. A committee of the National academy of sciences reported in favor of the change, the then secretary of war urged it, and a joint congressional commission recommended it, three members of the commission advising a gradual, and three an immediate, transfer from military to civil authority. Popular opinion very generally supported these recommendations, and the chief objections to them came from the military element of the service itself. All the official declarations of the service maintained to the last that a military organization was essential to success in weather-prediction. It might be forcibly contended, on the basis of published statements in the annual reports, that the service had for its first object the availability of its entire force in case of war, were it not that its whole public work refuted this theory. The real work of the service is the announcement of the approach and force of storms throughout the United States for the benefit of agriculture and commerce in time of peace.

No. 208—1887.

The people at large have taken a great interest in the government weather-bureau, and desire to see its work continued and its predictions improved. They would be glad to see an extension of scientific study in its offices, for on such study all its chances of better success depend. The opening of the third period in its history will therefore be watched with the deepest interest. The needs of the service must be thoroughly and deliberately considered. Immediate action, resulting in the appointment either of a military chief or of a civil director, would be deprecated on all sides, for the interests involved are too great to be endangered by hasty decision. Moreover, there is a very general desire, on the part of meteorologists and of scientists generally throughout the country, that they should at least be heard in the matter before decision is reached, so that whatever plan of future organization is adopted shall be based on full and open discussion. Deliberate action and authorized opportunity for consideration of scientific as well as of military methods are therefore of the first importance. It should be the earnest effort of all who have watched the development of the signal service thus far to secure these guaranties of its further progress.

MR. ATKINSON'S SECOND ARTICLE in the *Century* magazine, on 'The relative strength and weakness of nations,' is just as interesting as the first, to which we called particular attention at the

time of its appearance. In the present paper Mr. Atkinson considers the sources of the weakness of nations governed by dynasties, and presents some conclusions that must sound strange enough to the adherents of the 'blood and iron' policy. The writer also indorses Professor Seeley's conclusion that nearly all the European wars of recent times have originated in the desire of one nation to dominate a continent, or part of a continent, in order to build up colonies the commerce of which might be controlled by the mother-country. Mr. Atkinson points out that the fundamental fallacy here is economic, and consists in regarding commerce as a sort of war in which what one nation gains, others must lose. It was the international jealousy arising from pursuance of this policy that gave us for a mere song the vast territory embraced in the Louisiana purchase. This war-waging policy has resulted in the raising of funds by mortgaging the future through the medium of a national debt; and this, says Mr. Atkinson, has now become the chief source of the weakness of nations. He shows that the same century that has seen the European national debts increase from $2,600,000,000 to over $22,000,000,000 has also seen Spain, Portugal, Austria, and Greece become bankrupt, and Russia without credit.

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Large as our national debt seems, and is when compared with our financial history previous to the rebellion, it is small in comparison with the national debts of Europe. Indeed, as Mr. Atkinson says, when at its highest point in 1865, it was $84 per capita, an average which is equalled by the debts of the commercial and manufacturing states of Europe to-day. And while we have, omitting Alaska, 32.7 acres per head of population, Great Britain, Germany, France, Italy, Holland, and Belgium have only 2.8 acres per capita. On the other hand, while our national debt is only 73 cents per acre, that of the above-mentioned countries is $30.06 per acre. The force under arms in those countries, omitting the reserves, is at the ratio of one man to each two hundred acres, and the annual tax for his support averages $1.10 per acre. With us the ratio is one man to fifty-one thousand acres, and the annual tax for his support and for all other military purposes is something over three cents per acre. The war-waging countries have obtained, however, one advantage over us, which is probably due to the extent and perfection of their military systems; and that is, that while it takes $1,600 a year to sustain each man in the army and navy of the United States, — including the cost of ships, fortifications, navy-yards, and so forth, — the continental nations do it for $223 per man.

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Mr. Atkinson next proceeds to establish a comparison between the product per capita of European countries and that of the United States, at its measure in money. In this problem he takes the known factors to be the relative rate of wages paid in the countries considered, the relative amount of national taxation per capita, and the assumption that the value of the per capita annual product of the United States is two hundred dollars' worth. From these data Mr. Atkinson figures out the value of the product per capita of other countries by adding to the original elements of cost — the sum of the current rates of wages and the per capita taxes — from five to fifteen per cent as the corresponding profit. As a specific example of this computation, we have the following: "Assuming that one person sustains two others in France as well as in this country, we know first that the average wages in France are not more than sixty per cent the rate of wages in this country. We also know that national taxes are eighteen dollars per head in France, and less than five dollars here. We need, therefore, only to establish the rate of profit which will induce the employment of capital in the arts which can be established in France, in order to reach an approximate estimate of the average value of the product of each person employed in productive industry." Then, taking any group of skilled artisans in this country who earn two dollars a day, each supporting two other persons, the final value of the product of one such workman, following the method above outlined, would be six hundred and sixty dollars, divided into, profits, sixty dollars; taxes, fifteen dollars; net wages, five hundred and eighty-five dollars. The gross value of the French workman's product, similarly computed, is found to be four hundred and fourteen dollars, of which fifty-four dollars is diverted for taxes, and fifty-four dollars for profits.

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Many of the other statistics and conclusions are of equal interest with the above, but we have not space to quote them all. For example: if the "product per capita of the United States may

be valued at two hundred dollars' worth, that of England, with its income from foreign investments added, may not exceed one hundred and seventy-five dollars' worth; that of Great Britain and Ireland combined may be assumed not to exceed one hundred and fifty dollars' worth; that of France as not exceeding one hundred and twenty dollars' worth; that of Germany as not exceeding one hundred dollars' worth; that of Italy as not exceeding eighty dollars' worth; such being substantially the ratios which the average rates of wages, with the per capita national taxation added, bear to each other, and to the wages and taxes of the United States, with corresponding profits added in each case." Again: at the ratio which the national taxes now bear to product in the United States, the actual work required to sustain all the functions of the national government, directly or indirectly, is that of 500,000 men; whereas, if our ratio were that of England, the labor of 1,348,000 men would be required; if it were that of France, Germany, or Italy, the labor required would be that of 3,000,000, 2,400,000, or 2,950,000 respectively. Mr. Atkinson's final conclusions are full of interest and importance, and merit close attention and study.

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IN THE ISSUE of this journal for Jan. 7 will be found a formidable list of papers read before the Indiana academy of sciences at its last meeting on Dec. 29 and 30, 1886. An examination of the titles, together with the well-known scientific reputation of some of the authors, proves that there is a good deal of vitality in science in Indiana at the present time. Not many states west of the Alleghanies can boast of a more vigorous scientific society than this: indeed, the line might be drawn farther east without including one. The Indiana academy, although enrolling more than one hundred members, most of whom are actively interested in scientific work, was organized only a year ago. It doubtless owes its existence to the enthusiasm of the secretary of a village society of natural history, Mr. Amos W. Butler of Brookville, who, in the summer of 1885, assumed the labor and expense of the issue of circulars, appointing a meeting at the capital of the state on Dec. 27 of that year, and making all preliminary arrangements. With such men as Kirkwood, Jordon, Coulter, Owen, etc., as a nucleus, the academy was at once clothed with a dignity and character which drew to it nearly all in the state who were engaged or interested in scientific research. The second meeting, held a few weeks ago, was largely attended, the membership was greatly increased, and the society appears to be starting upon a career of usefulness, which it is hoped may be a long one.

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As might be expected, the natural history sciences have by far the largest number of votaries among its members at present. This is the result of example and environment; but mathematics, physics, astronomy, chemistry, etc., already have their representatives in the state, and will not be found slow to claim their share of the yearly programme. The great danger to which the academy is exposed is the possible loss of interest after the novelty of the thing has worn away. Let it not be in a hurry to increase its membership, and particularly let it be slow to follow the example of so many young societies in breaking up into a half-dozen or more 'sections,' none strong enough to stand alone, while all might do well together. The greatest good which such a society can do is to be found in the inspiration which it affords young men who attend its meetings and breathe its atmosphere. A society similar to the Indiana academy, well directed and full of vigor, in every state of the union, would be of incalculable benefit to the science of the country.

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ACCORDING TO PROFESSOR BAIRD'S annual report, the work of the Smithsonian institution during the past year has been carried on effectively but quietly, and without any incidents of special importance. The routine work seems to have increased largely, for the system of international exchanges now requires the constant labor of nine persons, while that of two formerly sufficed; and the correspondence, which also used to need but two persons to attend to it satisfactorily, now needs five. The urgent necessity for additional room for the government collections, and a congressional appropriation for its provision, are emphasized by Professor Baird, who says that a new museum building, equal in size to the present one, would scarcely furnish the needed accommodations, so rapid is the increase of the government collections. The lack of explorations during the past year is ascribed to lack of means to undertake any thing of magnitude. The publications of the year are commented on, and some interesting statistics given as to the working of the system of international exchanges. During the

past fiscal year there were 764 boxes of foreign transmissions, 14,496 parcels of domestic exchanges, and 143 boxes of government exchanges handled by the institution. Over two hundred thousand persons visited the Smithsonian institution and the national museum during the year.

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MUCH DIFFICULTY has been experienced in accounting for the occurrence of cases of contagious diseases, when, so far as could be ascertained, no exposure to any pre-existing case had occurred. These instances have been regarded by some as evidence of the possibility of their originating spontaneously. M. Verneuil has suggested a theory which, if true, would account for such anomalies. The microbes of disease, according to this view, remain in the skin and other portions of the body in a state of quiescence, and may continue thus inactive for years. By some means, as yet inexplicable, these microbes are aroused to a condition of activity, reproduce themselves in great numbers, and set out on their deadly mission. It is, in the absence of evidence to the contrary, much more reasonable to suppose, that, in the obscure cases in which exposure has not been recognized, such exposure has actually occurred, than to adopt a theory like this, which has not the slightest basis for its existence. If all cases which cannot be traced to their source were to be explained in this way, it would be the rule rather than the exception. A physician who had had large experience in an English small-pox hospital delared that not one case in twenty was capable of being referred to any known source of infection, the disease being ascribed by the patient to cold, fatigue, or some other innocent circumstance. The instance referred to by Sir Thomas Watson, in his essay on 'The abolition of zymotic disease,' should be a constant reminder to those who would refer the appearance of these diseases to a spontaneous origin. In 1829 a prisoner in Millbank penitentiary was attacked with small-pox, under such circumstances that it was thought no possible exposure could have taken place, and for thirty years the case was quoted as proof of the possible spontaneous origin of small-pox. In 1860 the fact for the first time became known that the physician of the penitentiary had come directly from a case of confluent small-pox in a neighboring town to the prisoner's cell, and had undoubtedly been the carrier of the disease.

## THE SUBMERGED TREES OF THE COLUMBIA RIVER.

THE attention of many tourists who have traversed the magnificent valley of the Columbia River through the Cascades, has been called to two phenomena which have excited their interest. One is the occurrence of submerged trees in the bed of the river: the other is the slow lateral creeping of the road-bed and track of the Oregon railway and navigation company. During the last summer I had an opportunity to make a brief study of these two subjects, and, as they are likely to prove of increasing interest, it may be worth while to recite the results of the examination.

The Columbia enters the Cascade barrier three or four miles below the Dalles. The platform of that range here has a width of eighty miles. From the Dalles to the Cascade Locks, a distance of over fifty miles, the Columbia flows as a broad, deep, quiet stream, with a sluggish current at low water. Its course resembles that of the Hudson through the highlands; and this fact is at once suggestive, because the passage of rivers through mountain-ranges is generally swift, and broken by many rapids. If it is otherwise, there is almost certainly an interesting reason for it. The Cascade Locks are situated almost exactly on the axis of the Cascade range. Here is a cataract which has always been an insurmountable obstacle to navigation; for, within a distance of a few hundred yards, the river makes a descent of about thirty feet. The government is now building a short canal with large locks, to enable steamboats from below to reach the still waters above. Beginning at a point about a mile and a half above the cataract, the traveller, as he sails up the river, observes many old stubs protruding from the water and from the sand-banks, laid bare during the low stages of the river. They are seen for a distance of thirty miles, recurring at frequent intervals, here clustered thickly together like the piles of an old wharf whose superstructure has decayed and vanished, there with wide intervals between them. During high water these tree-trunks are entirely submerged. An examination of the wood serves to identify them with the living species of fir which form the forests upon the mountains and cliffs round about.

These submerged trees, together with the long still reach of water above, at once suggest that an obstacle has been placed athwart the stream, forming a dam which converted the river-valley above it into a long narrow lake, and that the rising water submerged an old forest of which these trees are the vestiges. Indeed, this is the only explanation which suggests itself. It is strongly

corroborated by many other circumstances which need not be enlarged upon here. No geologist who has visited the locality has ever doubted, so far as I know, that this is, in general form, the true explanation. The only question which arises is about the nature of the obstacle which has dammed the river. Dr. Newberry, who visited the place in 1855 in connection with the Pacific railroad surveys, suggested that it might be due to the slipping of the bank of the river into mid-stream at the Cascades, thus throwing the current upon the southern bank. This idea has diffused itself among the people of the neighborhood, and is frequently spoken of as the *vera causa*. In support of this view, reference is frequently made to the second fact: viz., the slow lateral creeping of the railroad-track on the southern bank of the river.

Desiring to see these phenomena, which seemed to promise much instruction, I made a visit to the place, and devoted a couple of days to their examination. As regards the creeping of the railroad-track, the explanation is patent as soon as the spot is visited. The place is situated on the south bank, about a mile below the cataract. The materials which are creeping are felspathic sands, deposited by the river itself in irregular strata, and now undergoing rapid decomposition and kaolinization. The products of decomposition become a smooth slimy clay; and having a rather steep front toward the river, which is here a swift and powerful torrent, the slope of the bank is a little too steep for stability. The materials, being of a somewhat unctuous character, flow easily with a slow glacier-like motion. The phenomenon, however, is a local one, limited to a stretch of only a few hundred yards, and does not occur anywhere else in the neighborhood, so far as I am aware. The bed-rock beneath it is disclosed, and there is no indication that it participates at all in the motion: on the contrary, the indications are very plain that it does not. It also became evident, that, whatever might be the origin of the obstruction which has backed up the Columbia River for nearly fifty miles, this particular phenomenon has had nothing whatever to do with it; though possibly it may be, and probably is, a remote consequence of the obstruction. It certainly is not the cause.

In looking upon the north bank for indications of a slide which could have precipitated any obstruction across the channel, I was unable to find any. On the contrary, the more carefully the ground was studied, the more difficult it seemed to reconcile this supposition with the facts; for there is no steep elevated ground, from which an obstructing mass could have slidden, nearer than three miles. The river-valley is here very wide, and north of the river lies its ancient flood-plain, which consists of ancient lavas and conglomerates in heavy masses, planed to an approximate rough level, with patches of river-gravel and sands scattered over it. The study of this old flood-plain disclosed facts which seemed to furnish a much more satisfactory solution of the problem.

Beginning at a point about a mile above the cataract, this flood-plain is seen to ascend as we go down stream. If the proper stand-points are selected, this slope in the wrong direction is conspicuous to the unaided eye. But we need not rely upon such a means of verifying the fact, for the relation of the river, as it now runs, to the older flood-plain, tells the story with emphasis. A mile above the rapid the old flood-plain is no more than thirty feet above the water; a mile below the rapid it is about two hundred feet above it; while the fall of the river itself in that interval is not more than forty feet. The inference seems decisive. There has been an uplift of the entire platform athwart the river-valley in the shape of a very flat anticlinal arch. The width or span of this arch is about five and a half miles, and the eastern branch of the flexure is steeper than the western. The displacement is not recent in a historical sense, but it is probably post-glacial.

The effects of such an obstacle would be manifold. Not only would it dam the river, but it would set up below the cataract an action which it is important to consider. A great river, thus obstructed, at once attacks the obstacle with immense power. And the more pronounced the obstacle, the more vigorous the attack. The Columbia has already cut through it a low, inner gorge somewhat similar to that of the Niagara River below the falls. The rapid at the locks is steadily receding, and, if no further displacement occurs, it will probably require not more than a century or two for the river to have cleared a passage deep enough to drain the slack-water reach above. The work of cutting a passage through the obstruction five and a half miles in length is nearly complete. That the dam was once higher than now, is also to be inferred. Year by year it is getting lower. The effect of the obstacle upon the slack water above it is also plain. The flow of the water being retarded, it drops its sediment, and the river-bed is gradually built up. Thus the trees which grew along the flood-plain before the upheaval were not only submerged, but were buried in sand and gravel. When the dam was higher, they were more deeply buried than now. As the dam is gradually cut down, the trees are slowly exhumed again. But it is well known that trees submerged in fresh water and buried

in silt may last for thousands of years. Only when brought into the open air again does the process of decay go on with ordinary rapidity.

It is no light thing for any observer to feel obliged to differ from Dr. Newberry concerning the interpretation of facts in the field. It has been my fortune during the last three years to traverse regions previously trodden by him in New Mexico, Arizona, California, and Oregon, and I have left them with a profound admiration for the sagacity and the wonderful accuracy, rapidity, and penetration with which he mastered the facts. This, I believe, is the only instance in which I have been led to a conclusion differing in any important respect from his.

C. E. DUTTON.

## THE HEALTH OF NEW YORK DURING DECEMBER.

THE department of health of the city of New York estimated that the population of the city on Dec. 1 was 1,457,356, or nearly one and one-half millions of inhabitants. Of this number, 3,502 died during the month. This latter statement is not strictly accurate, as in it no account is taken of the natural increase in the population, which, over and above those who die during the month, is not far from 3,300, or more than 100 each day. As compared with November, there were 426 more deaths in December. The greatest mortality on any one day was on the 6th, when 144 persons died. The deaths due to diarrhoeal disease were but 65, the smallest number since the month of April. Of children under five years of age, there were 1,531 deaths, 241 more than in the preceding month. Consumption caused 478 deaths, a slight increase over November; diphtheria, 218 deaths, 30 more than in the previous month; and scarlet-fever, 23 deaths, the identical number of deaths which the November records charge to that disease. As will be seen by a glance at the chart, measles figured very prominently among the mortality factors, causing 271 deaths, or more than scarlet-fever and diphtheria together. During the month of November there were 166 deaths due to measles.

The highest temperature of the month was 55° F., on the 24th at 10 P.M. This is not so high by five degrees as the corresponding month in 1878, which was the lowest maximum for the decade; the average for the ten years being 66.2° F. The minimum reached by the mercury was 13° F., on the 5th at 6 A.M., and again on the 17th at 8 A.M. During no December since 1877 has the thermometer been so low, while the average for the decade is 20.8° F. It will thus be seen that December, 1886, was an unusually cold month as compared with the corresponding month for ten years past. The amount of rainfall was 2.79 inches, including 10¼ inches of snow, 5¼ of which fell in one day, the 5th. During December of 1885, snow fell on but one day, and then in such small quantity as to make its measurement impossible. In the previous year, 10⅝ inches of snow fell in December, and in 1884 the amount was 22½ inches. The average December rainfall for the ten years commencing 1877 was 3.37 inches.

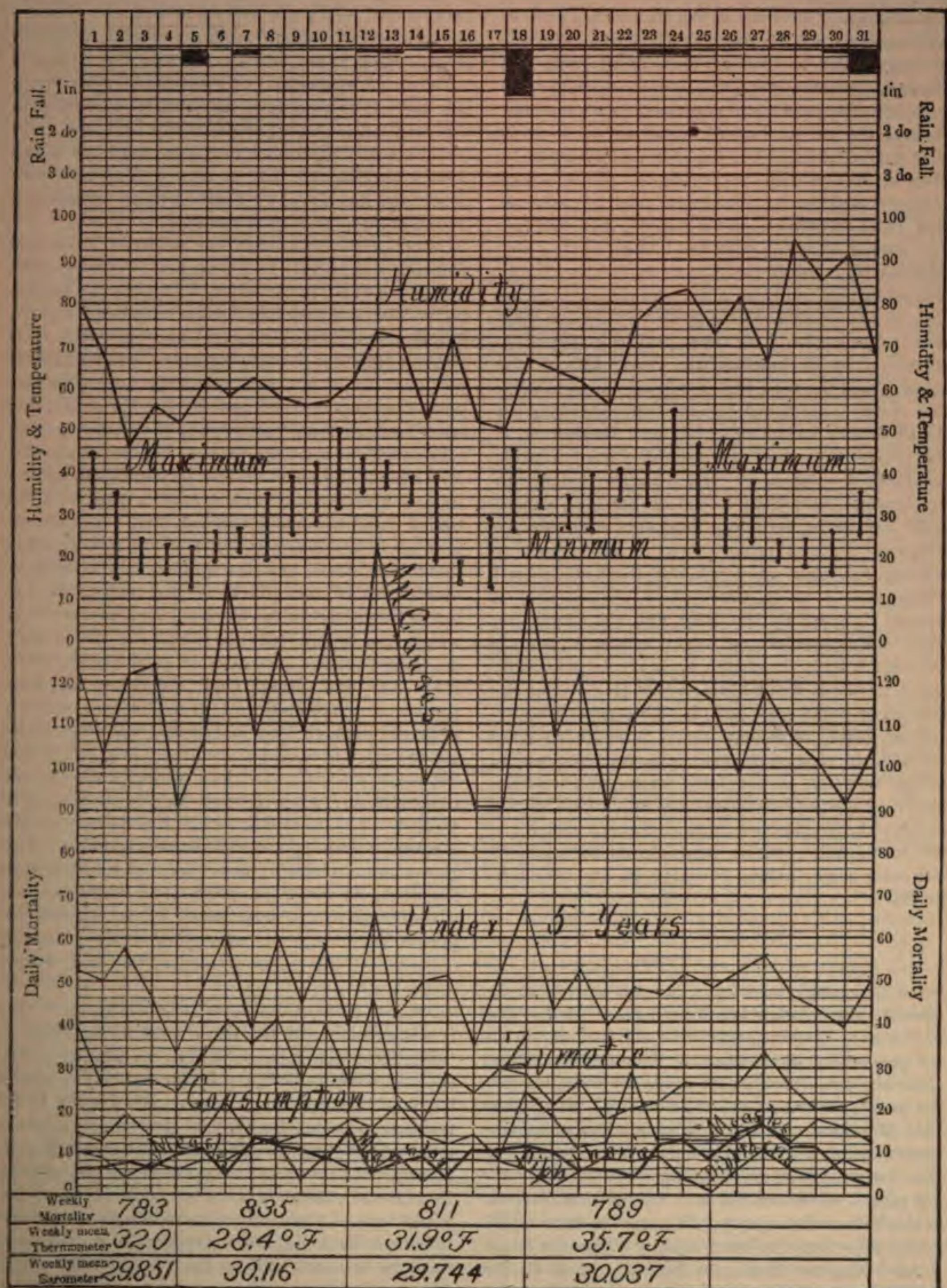
The following tables are of interest as showing the total mortality during the year ending Dec. 31, 1886, as compared with 1885: —

*Deaths in New York for* 1885 *and* 1886.

| | 1885. | 1886. |
|---|---|---|
| Under 5 | 15,267 | 16,121 |
| Zymotic | 9,100 | 9,669 |
| Scarlatina | 559 | 371 |
| Measles | 736 | 663 |
| Diphtheria | 1,325 | 1,7[illegible]7 |
| Typhoid | 294 | 325 |
| Diarrhoeal | 3,4[illegible]6 | 3,494 |
| Phthisis pulmonalis | 5,196 | 5,477 |
| Total | 35,682 | 37,251 |

| 1886. DEATHS FROM | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scarlatina | 49 | 43 | 42 | 49 | 44 | 29 | 25 | 15 | 11 | 18 | 23 | 23 |
| Measles | 5 | 2 | 8 | 10 | 17 | 26 | 58 | 36 | 21 | 48 | 166 | 271 |

Scarlet-fever caused fewer deaths in the former than in the latter, while diphtheria and typhoid-fever have been more fatal. Measles has of late excited a good deal of public alarm, and justly so, as shown by the table. While in January it caused but 5 deaths, decreasing to 2 in February, and not notably increasing until the summer, when November set in, the mortality suddenly rose to 166, and continued its upward course in December, carrying off 271 persons. The total mortality of the year was less than in 1885, but more than one-third of it took place in the month of December, and more than two-thirds in the two months of November and December. Consumption (phthisis pulmonalis) is, as usual, at the head of the column of the causes of death. The researches of Koch and others, which have


Rain Fall.
Humidity & Temperature
Daily Mortality
Humidity
Maximum
Minimum
All Causes
Under 5 Years
Zymotic
Consumption
Weekly Mortality
783
835
811
789
Weekly mean Thermometer
32.0
28.4°F
31.9°F
35.7°F
Weekly mean Barometer
29.851
30.116
29.744
30.037

cleared up many obscure points in the causation of this disease, have not as yet shown us how to materially reduce the number of victims who are annually claimed by it. That more than five thousand persons annually die in a single city from one disease is a sad commentary on sanitary science, and yet the best of minds are at work to solve the problem of the measures which must be adopted to diminish its ravages. That three thousand and more individuals, mostly children, died from diarrhoeal diseases, does not surprise one who is familiar with the intense heat of our midsummer; and in great measure this is largely beyond control. It is true, something may be done to reduce this mortality by visiting the poor sick and prescribing for them, and by giving them opportunities to breathe the fresh air of the country and the sea; but, when all has been done that can be, diarrhoeal diseases will still carry off the little ones by the hundreds and thousands, if the temperature and the humidity are favorable for their development. Diphtheria, which was unknown in New York until the year 1852, caused 1,727 deaths in 1886, and has, ever since its appearance, figured prominently in the mortality returns, its origin unknown, and its treatment not understood even by the best of physicians, — a disease dreaded by the laity and the profession alike in all parts of the world where it has obtained a home. It should, however, be constantly borne in mind, that although this class of disease cannot be eradicated, still, if all restraint were removed, their mortality would probably increase tenfold. In view of this, the department of health, whose function it is to keep watch of the localities in which these diseases do most abound, should receive the hearty co-operation of every member of the community, and be furnished by the authorities with ample means to carry on its beneficial work.

## *PARIS LETTER.*

AT yesterday's meeting of the Academy of medicine, Professor Grancher read a paper on the case of the man Réveillac, who died of hydrophobia after preventive inoculation, in which he corrected some erroneous statements made by Professor Peter at a previous meeting [see p. 96]. It appears that Réveillac submitted to only nineteen operations instead of thirty-six, as had been stated, and the treatment was much milder than in more serious cases. Moreover, the first information received at the Pasteur laboratory, of the unfortunate man's death, was from M. Peter's paper at the academy.

According to Professor Béclard, dean of the medical school, there are at present 108 women studying medicine in Paris. Of these, 83 are Russian, while only 7 are natives of France. The total number of female students would be much larger were it not for the necessarily stringent rules as to admission. Two women are among the present competitors for posts as assistants in the hospitals, of whom one, Miss Klumke, will doubtless succeed, much to the discomfiture of her male competitors. She is one of Vulpian's students, and has already published many interesting memoirs on neurological subjects.

Telephonic communication between Paris and Brussels will shortly be established; recent experiments between those cities, with wires of bronze instead of iron, having given excellent results. The distance is 330 kilometres, and the same wires will be used for both telegraphic and telephonic purposes, as it has been demonstrated that one wire can be used successfully for the simultaneous transmission of both kinds of despatches.

At a recent meeting of the Biological society, M. Laborde, director of the physiological laboratory of the medical school, read a paper on the use of water in fasting experiments. It is known that Succi and Merlatti drank water freely during their long fasts, and the public was divided in opinion as to the effects of the water. M. Laborde has ascertained by experimental tests that water is of great value in sustaining life during prolonged fasts. Two dogs, in good health, of the same age and breed, each weighing 15½ kilograms, were selected, one of which was entirely deprived of both food and drink, the other being given only a litre of water daily. Dog No. 1, that deprived of both food and water, died on the twentieth day, after having lost 7½ kilograms in weight. The other dog was well and lively on the fortieth day, though it had lost nearly 8 kilograms. It would undoubtedly have been able to live still longer on its water diet; but after its 40-day fast it was treated to a good meal, when, without apparent ill effects, it disposed of 1,200 grams of soup and 1 kilogram of meat. The dog is now doing well.

Two or three new books deserve notice. One is a translation, by Dr. H. de Varigny, of Preyer's 'Die Seele des Kindes,' a very interesting work, dealing with its subject in an entirely new and thoroughly scientific manner. Mr. Preyer is by training a physiologist, and has made a great many interesting physiological observations concerning children. It may be remarked that a French translation of another book of his, 'The physiology of the embryo,' to which the first-mentioned work is in many respects a sequel, will soon be brought out by the same publisher, F. Alcan. Preyer's books are very valuable, and it

must be said that he was the first to study in so scientific and severe a manner, and with such persevering patience, the subject treated of in 'Die Seele des Kindes.'

A book on animal magnetism, by MM. Binet and Féré, has recently appeared. It is really a book on hypnotism, as most phenomena ascribed to animal magnetism are of an hypnotic nature. The book is a good one. After some preliminary chapters devoted to the experiments of Mesmer and others, the authors speak of modern hypnotism, of the different methods of inducing hypnotic sleep, and of the symptoms and degrees of this sleep. They then give a theory of hypnotic suggestion, with a long review of the phenomena produced under its influence. A specially good chapter treats of the therapeutic and pedagogic applications of hypnotic suggestion. The book treats the subject fairly and fully, and will prove useful. Another new book, on hygienic dietetics, is from the pen of Prof. G. Sée. It begins with an exhibit of the comparative nutritive powers of different foods and a physiological study of the alimentary process. The rest of the book is devoted to the practical treatment of diseases by a judicious choice of foods. M. Sée is well informed upon the subject, and his book is consequently valuable, although it does not contain much original matter. V.

Paris, Jan. 13.

## NOTES AND NEWS.

THE first annual convention of the Society for the prevention of the adulteration of foods, drugs, and medicines met in Washington last week. The object of this society is the establishment of a certain fixed standard for every article of food, drink, and medicine, with the requirement that all articles not up to the standard shall be so marked by a label. About one hundred and twenty-five delegates were present from all parts of the country. Mr. H. Wharton Amberling of Philadelphia was elected president, and Mr. Elisha Winter, secretary. The president read his annual address, in which he spoke of the want of proper legislation on the subject of adulterated food, the sale of which, he claimed, produced nearly all the cases of kidney-trouble in the land.

— The secretary of the treasury has transmitted to congress the estimates of deficiencies in appropriations for salaries and expenses of the National board of health during the present fiscal year, amounting to $7,500. In a letter accompanying the estimates, the secretary of the board earnestly urges the importance of making the appropriation requested, but says, in case it is deemed undesirable to continue the work which has for its object the preservation and improvement of the health of the people, the laws devolving such duties upon the board should be repealed.

— The fine, large, gold medal given to General Grant for distinguished services in the Mexican war, now at the national museum, is bogus, having a specific gravity of only seven instead of sixteen.

— A memorial has been presented to congress, signed by prominent literary and scientific men and representatives of several historical societies, setting forth the great value and importance of a full and accurate digest and catalogue of the numerous documents found in public and private archives of Europe relating to the early history of the United States, and especially to the treaty of Paris in 1763, and the treaty of peace between the United States and Great Britain in 1783. Most of these documents are unknown to the American student, and but few of them have ever been copied, owing to their inaccessibility. Mr. Benjamin Franklin Stevens of London has, after many years' labor, prepared a descriptive catalogue of over 95,000 separate papers found in the archives of different European countries. The secretary of state recommends to congress the purchase of this descriptive catalogue, and adds, "Without its favorable action, not only will the completion of the work be doubtful if not impossible, but the fragment now prepared would probably remain practically valueless." Mr. Stevens, in a letter to the secretary of state, says that the work has become too great for any individual to undertake alone, unless a man of wealth, and that when complete the index will probably comprise 150,000 documents, and fill 20,000 royal octavo printed pages.

— Lieutenant Pillsbury, commanding the Blake, has started south for the season's work, and will run several lines of current observations from Cuba to Yucatan, and from Cuba to Florida Reef, and thence northward to San Antonia. This is a continuation of the work of last year, which was so successful. The connection between the velocity of the Gulf Stream and the advent of the tidal wave on our coast has been accurately determined, and the credit for this important discovery is due to Lieutenant Pillsbury. Appendix No. 13 to the coast-survey report, 'On the harmonic analysis of the tides at Governor's Island, New York harbor,' by William Ferrel, shows the results of tidal observations. The report states that the tides at Governor's Island and at Sandy Hook are very similar. The epochs at Governor's Island are somewhat greater, and the tides are thus

twenty-nine minutes later, than at Sandy Hook. The tides are not affected by waves coming through Hell Gate from the tides in the Sound above. The results of Mr. Ferrel's analysis show that it is not necessary to make separate tide-predictions for both Sandy Hook and Governor's Island, since the latter may be obtained from the former by simply adding twenty-nine minutes to the times. Other important appendices to the coast-survey report for 1885 are, 'The geographical distribution and secular variation of the magnetic dip and intensity in the United States,' C. A. Schott; 'A plea for a light on St. George's Bank,' Henry Mitchell; 'On geodetic reconnaissance,' C. O. Boutelle; 'Note on a device for abbreviating time-reductions,' C. S. Peirce.

— The coast-survey steamer Patterson, which has been laid up since last October at the Mare Island navy-yard, is being overhauled and painted, to return to survey work on the Alaska coast early in the coming spring.

— Lieut. William H. Emory, who commanded the Bear on the Greely relief expedition, has been ordered to the Thetis, and will shortly sail for Alaska. He will investigate the seal-fisheries, and has received special instructions regarding the boundary-line between Alaska and the British possessions.

— The will of the late Isaac Lea was admitted to probate Jan. 22. The document is a voluminous one, and contains twenty codicils. The will bears date of execution May 25, 1878, and the final codicil July 30, 1885. The petition, which was filed by the executor with the document, places the value of the estate left by the decedent at about three hundred thousand dollars. He bequeathed his collection of fresh-water shells, marine and land shells, minerals, fossils, and geological specimens to the Academy of natural sciences of Philadelphia; but in a codicil dated Feb. 28, 1880, he says, "I revoke that part of my will which gives to the Academy of natural sciences at Philadelphia my collection of natural history, and I give them all to the national museum at Washington, D.C., on condition that the national museum shall devote a room exclusively for the Unionida, Stremopatida, Physaida, Paludinaida, Pulmonifera, and others, the Unionida to be put in the exact order in which they now are, with their labels as I have placed them; the whole to be called 'The Isaac Lea collection;' the Muscovite collection to be placed in this room likewise." A codicil executed on Oct. 1, 1884, reads, "Believing it important to the early history of the development of the fluviatile and terrestrial Mollusca of the United States to have some of my correspondence published, as well, also, some other subjects, I desire my executors to devote a thousand dollars to the object, provided they may agree with me in that opinion."

— A recent bulletin of the New England meteorological society states that the records of a meteor seen from many points in New England on the evening of September 6 were submitted to Prof. H. A. Newton of Yale college, who reported as follows: the meteor had an altitude of about 90 miles when first visible, over latitude 44° 15′, longitude 73° 8′; and an altitude of 25 miles when it disappeared, over latitude 43° 20′, longitude 71°. One of its explosions occurred near the middle of the path, the other near the end. The meteor was going away from the sun, having had a perihelion distance of about three-quarters of the earth-orbit radius. An extract is added from one of Professor Newton's earlier papers. The altitudes of 78 meteors observed on Nov. 13–14, 1863, were calculated as follows: mean altitude at first appearance, 96.2 miles; at disappearance, 60.8 miles; at middle path, 78.5 miles. Twenty-nine of these meteors became visible at greater height than a hundred miles, and seven disappeared before descending to this height. For 39 meteors observed on Aug. 10–11, 1863, the corresponding mean altitudes are 69.9, 56.0, and 62.9 miles (*Amer. journ. sc.*, xi., 1865). It is desired that observers should report the position of bright meteors, noting their paths among the stars with as much accuracy and detail as possible. The drift of the trail left by the meteor should be closely observed, as it indicates the direction of upper winds. The simple record that a meteor was seen is of very little value alone.

— The use of salicylic acid has become so prevalent to prevent fermentation in food-products, that a committee of the Académie de médecine has had the matter under consideration, and, in a report recently made on the subject, says, "It being well established by medical observation that feeble and prolonged daily doses of salicylic acid and its derivatives can cause considerable trouble to the health of certain persons who are sensitive to those forms of drugs, particularly old people and in those whose venal or digestive functions are no longer in perfect order, therefore the addition of the salicylates to liquid and solid aliments will not be permitted."

— The agricultural appropriation bill reported last week from the committee on agriculture carries the following amounts for the support of this service during the next year: experiments with southern cane, $32,000; experiments in silk-culture, $15,000; slaughtering cattle, $100,000; cattle quarantine, $20,000. The total amount recom-

mended in the bill is $563,730. The committee also recommend that the statistician of the department be sent to Europe to attend the international agricultural convention, and that $15,000 be appropriated therefor.

— The report of Mr. J. R. Dodge, statistician of the U. S. agricultural department, on the sugar-production of the world, contains some interesting data. According to the figures presented, the amount of beet-root sugar produced in the season of 1886–87 exceeds the cane-sugar by 162,000 metric tons, thus showing that more than half the sugar used in commerce is extracted from the beet. The manufacture of beet-sugar is entirely a European industry. Mr. Dodge states that its success in Europe is largely due to the 'beet-stock' plan, where each shareholder in the stock of a beet-sugar factory is required to furnish so many beets per share. The farmers are therefore, in reality, the manufacturers, and, since they obtain the profits of the manufacture, they are the most interested in raising good beets at a nominal price. The total consumption of sugar in this country in 1885 was 1,245,574 tons, of which only 40,000 tons (or about three per cent) were produced here. There is only one beet-sugar factory in this country, and that is in California, which produces sugar at five cents per pound, and has to compete with free sugar from the Sandwich Islands. The report further states that our sugar-consumption amounts to about one-fourth of all the sugar reported from the countries of principal production, and that within twenty-five years more than 2,000,000 tons will be required, almost sufficient to swallow up the present production of beet-sugar, or the whole of the present cane-sugar of commerce. The report concludes as follows: "At a time when labor is in excess of demand, and corn and wheat and cotton, and other old staples of a primitive agriculture, exceed the wants of domestic and foreign markets, we scour the world for food-products costing more than $200,000,000 per annum, the larger portion of which should be produced in the United States. This primitive and unenterprising situation must be surmounted by a more skilful, scientific, and inventive agriculture."

— The first number of the *Centralblatt für bacteriologie und parasitenkunde*, edited by Dr. Oscar Uhlworm of Cassel, is announced for the beginning of the present year. Professor Leuckart of Leipzig, and Dr. Loeffler of Berlin, are associated with Dr. Uhlworm. At the urgent request of the editor, Dr. George M. Sternberg, U.S.A., has consented to act as a collaborator in the United States. As its title implies, this publication is to be devoted to bacteriology in all its branches and to animal parasites which affect man, the lower animals, and plants. The editor is especially desirous of securing all original American papers relating to this field of investigation, whether recording experimental work or improvements in technique. Authors of such papers are kindly requested to send reprints to Dr. Sternberg, in care of Johns Hopkins university, Baltimore, Md.

— The new chemical laboratory of the University of Nebraska was dedicated Jan. 14.

— *Gaillard's medical journal* states that Dr. Valentine Mott has been making a series of preventive inoculations in the case of two sons and an office-boy of Dr. Foster of Yazoo county, Miss., who were bitten by a rabid dog in November. The process has been completed, and the children are all in good condition.

— Small-pox, which has been so notably absent from New York City, has now made its appearance there, eighteen cases having been reported during the week ending Jan. 22, of which two were fatal. 651 cases of measles with 86 deaths, and 130 cases of diphtheria with 38 deaths, are reported for the same period.

— Three new comets are announced. The first was discovered by Thome, Dr. Gould's successor at the Cordoba observatory in South America, on Jan. 18, in the constellation Grus. The despatch states that it resembles the great southern comet of 1880, and is likely to become a brilliant object. The second comet was discovered by Brooks on Jan. 22, in the constellation Draco, and in this latitude is now visible, with the help of a telescope, throughout the night. The third was discovered by Barnard on Jan. 23, and is in Vulpecula; it is also telescopic, setting in the early evening.

— Dr. F. V. Hayden, formerly director of the U.S. geological and geographical survey of the territories, has resigned from the position that he has held for several years in the present U.S. geological survey.

— Indianapolis, Ind., has been considerably excited of late over an instance of remarkable preservation of the human body after death. A lady died in that city some thirty years ago, and her body, incased in an iron coffin, was placed in a vault. A recent examination showed that the body was in a wonderful state of preservation. The *Indiana pharmacist* says that even the color of her eyes, a deep blue, could be recognized. The hair had grown to a length of two feet. It was supposed by the sexton to have turned to stone,

but further investigation showed it to have become changed into that peculiar substance known as adipocere. Adipocere (*adeps*, 'fat,' and *cera*, 'wax') has somewhat the appearance and consistence of cheese, and is a compound of oleic and margaric acids with an alkali. It has usually been formed in bodies that are buried in the earth, and moisture has been supposed to be essential in its formation. In the instance just referred to, the body was in a dry vault. There seems to be no fixed time necessary for this change to take place. One instance is reported of an infant which had been but three months in a cesspool, in which adipocere had formed, while in other cases years seem to have been necessary.

## LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### National prosperity.

IN Mr. Atkinson's paper in the January *Century* there are some uses made of statistics which seem to a layman at least a little queer.

He gives us a table of enormous percentages to show how greatly the United States have increased in productiveness and wealth.

Since 1865 we are told the yield of hay has increased 106 per cent; of cotton, 194 per cent; of grain, i.e., wheat, corn, oats, barley, rye, and buckwheat, 256 per cent; railway mileage, 280 per cent; insurance against fire, 310 per cent; output of pig-iron, 386 per cent; and population, 69 per cent. The ratios are seemingly wonderful, but in some cases very deceptive, most so in cotton. In 1865 the number of bales was 2,228,951, and in 1885, 6,550,215, a gain in twenty years of 194 per cent. Will it be surprising to be told that the gain is not 194 per cent, but only 22 per cent? Here it is.

In 1860 the number of bales recorded was 5,387,052, on which the gain in 1885 is but 22 per cent. Why does the statistician take the phenomenally low year of 1865, which was behind 1850 even? We have merely regained the position of 1860, and advanced 22 per cent.

And as to increase, the gain from 1850 to 1860 with slave-labor was 118 per cent, in ten years, — an average of $11\frac{8}{10}$ per cent per year, which, compared with the free-labor rate, $9\frac{7}{10}$ per cent per year, shows that the increased production under free labor is somewhat of a myth. At the slave-labor rate of increase, the twenty years from 1865 to 1885 would have culminated in a crop of 7,489,275 bales. In what, pray, does the superiority of free labor make itself manifest?

Population, we are told, has increased 69 per cent since 1865; from 1860 to 1870 the increase was 23 per cent, $2\frac{3}{10}$ per cent per year; from 1870 to 1880 it was 30 per cent, or 3 per cent per year; from 1880 to 1885 we find a gain of 14 per cent, or $2\frac{4}{5}$ per cent per year.

Now, from 1850 to 1860 the increase was 36 per cent, or $3\frac{6}{10}$ per cent per year, a higher rate than that of any decade since then. Had we increased from 1865 to 1885 at the rate of the decade before the war, we should now number over 61,000,000 instead of 56,975,000.

256 per cent, we are told, has our grain-crop increased from 1865 to 1885. The grain-crop of 1865 was over 100,000,000 bushels less than that of 1860. By decades we find that the increase between the years 1860 and 1870 was 32 per cent; 1870 to 1880, 50 per cent; and from 1880 to 1885, 23 per cent, or $3\frac{2}{10}$ per cent, 5 per cent, and $4\frac{6}{10}$ per cent per year respectively. The gain from 1850 to 1860 was 43 per cent, or $4\frac{3}{10}$ per cent per year; and if we calculate from 1860 to 1885 at the same rate, 43 per cent per decade, we find due us a crop of 3,060,428,664 bushels as against 3,014,063,984; and the marvellous gain of 256 per cent over 1865 appears less than was to be expected from what we were doing before the war. The hay-crop of 1882 would have amounted to about 600,000 tons more, if it had been the result of an increase as from 1850 to 1860. Since 1882 the hay-crop jumped from 38,000,000 tons to 48,000,000 in two years, a truly phenomenal increase.

Railway mileage has increased 280 per cent since 1865; but, if we are to talk of per cents, let this gain of twenty years be compared with 217 per cent, ten years' gain from 1850 to 1860. In miles the gain has been from 1850 to 1860, 21,500; 1860 to 1870, 22,400; 1870 to 1880, 40,700; 1880 to 1885, 32,000.

It would be of interest to see if the net income has increased *pro rata*.

For progress in wealth we are shown a table of fire-insurance risks, and an increase therein of 310 per cent since 1865. Why not take the assessed value of all real and personal property? This was, in 1850, \$7,000,000,000; in 1860, \$13,000,000,000; and in 1880, \$17,000,000,000. Of course, there is an increase since 1865, but in per cent it does not compare with that from 1850 to 1860.

As to pig-iron and its 386 per cent increase since 1865, it will take a pretty stiff-necked protectionist to understand how, under the conditions of its production, it stands for 386 per cent increase of wealth to the people who have to use it and pay for it.

And now, if, to make the showing a little more comprehensive, we look at the number of acres of improved land, we find that it increased 44 per cent from 1850 to 1860, 16 per cent from 1860 to 1870, and fifty per cent from 1870 to 1880, — an average of $3\frac{2}{3}$ per cent per year, — very close to the increase in population. The value of agricultural implements increases, from 1850 to 1860, 62 per cent; 1860 to 1870, 37 per cent; 1870 to 1880, 2 per cent; annual average, 4 per cent.

Rice production has fallen from 215.000,000 pounds in 1850 to 110,000,000 in 1880. Tobacco, which gave an increase of 117 per cent from 1850 to 1860, and in 1860 had 434,000,000 pounds, has but 472,000,000 in 1880.

Irish potatoes increase 69 per cent, 29 per cent, 18 per cent, respectively for the three decades, or the average of $3\frac{8}{10}$ per cent per year.

Sweet-potatoes fall from 38,000,000 bushels in 1850 to 33,000,000 in 1880. Cheese, also, which was at 105,000,000 pounds in 1850, is in 1880 only 27,000,000 pounds. Butter rises 46 per cent, 12 per cent, and 21 per cent through the three decades, an average of 2.6 per cent per year. Live-stock gains 100 per cent from 1850 to 1860, 40 per cent from 1860 to 1870, and falls off 6 per cent between 1870 and 1880, an average rate of increase of $4\frac{3}{4}$ per cent.

And while our public debt has been decreased by \$876,970,833 between 1865 and 1880, we find on hand in 1880 a state, county, and town debt of

$1,056,406,208, which seems to show that the revenue which went to reduce the national debt has been diverted to local improvements, and has become a wealth-producing power.

Comparing, now, the average increase by decades since 1850, we find population at about 30 per cent per decade; hay, except for 1883 and 1884, 36 per cent; cotton, 40 per cent; grain, 42 per cent; railway mileage, 115 per cent; improved land, 37 per cent; agricultural implements, 40 per cent; Irish potatoes, 38 per cent; butter, 26 per cent; live-stock, 47 per cent; assessed valuation, 40 per cent; while rice, sweet-potatoes, and cheese have decreased 50 per cent, 14 per cent, 74 per cent, tobacco is as in 1860, and our debts have simply changed form. This statement of average increases per decade shows how closely together the various values have kept for thirty-five years. The great advance since 1865 has now about brought us up to the place we should expect had the war not interrupted our development. Production has advanced only a little faster than population, and this is probably due to improved implements, improved methods, greater demand, and more facilities for handling the crops, i.e., railways.

C. H. LEETE.

New York, Jan. 22.

## Professor Newberry on earthquakes.

In his notice of my article on earthquakes, in *Science* of Jan. 7, Mr. Everett Hayden intimates that I am not warranted in my statements in reference to the cause of earthquakes and the condition of the interior of the earth, citing the diversity of opinion which is on record, and the authority of great names opposed to me, as a reason why I should exhibit greater modesty.

I am sorry that I cannot see the matter from Mr. Hayden's stand-point. If he has any facts or arguments to offer which militate against the statements I have made, I shall be most happy to consider them, and I shall be convinced by them if they are convincing; but, without facts or new arguments, we may well be spared the appeal to authority. A blind deference to the utterances of great men has done geology much harm. Sir William Thomson has no more sincere admirer than myself, both for his genius and his nobility of character; and yet I do not hesitate to say, that by his unwarranted statements in regard to the condition of the interior of the earth, a matter in which his mathematical genius and learning give him no fitness to speak authoritatively, he has seriously retarded the progress of geological knowledge. From the phenomena of the tides and the precession of the equinoxes, he has inferred and asserted that the figure of the earth is as inflexible as though it were composed of glass or steel. There is, however, a doubt in the minds of many physicists whether the tides and the precession of the equinoxes afford such delicate and quantitative tests of the constancy of the earth's figure as to warrant these conclusions. Hennesy and Delaunay have shown that the argument from the precession of the equinoxes, at least, is weak; but, even if the fact of the constancy of the earth's figure be conceded, the inference that it is because of a rigidity of the earth's material equal to that of glass or steel, is certainly unwarranted. The argument proves too much: we all know that the materials composing the earth's mass are *not* as rigid as steel. The facts connected with earthquakes, volcanoes, mountain-chains, and the oscillations of the level of coasts, which I briefly cited in my article, show conclusively that the earth is not an unyielding solid; and I have suggested that the want of homogeneity in the materials composing it, — partly solid, partly viscous, partly fluid, — under varying conditions of pressure, may neutralize the tendency to distortion from the changing attractions of the sun and moon. The facts cited by geologists as disproving the absolute rigidity of the earth are unquestionable, and their arguments are cumulative and unanswerable. Hence astronomers must find some other explanation of the constancy of the figure of the earth — if that be proved — than a solid interior.

I am only exercising my inalienable right, am defending my hearth and home, when I protest against the invasion of our field of research by masters in other departments of science, however gifted, who, with imperfect knowledge, hurry to conclusions incompatible with those which geologists have reached by lifelong study. That Sir William Thomson did not give to the geological facts due consideration when he uttered his dictum, is shown in his original paper read before the Geological society of Glasgow in 1879. Here in advocating the theory that the earth is solid, and that the solidification began at the centre, the result of the cooling and sinking of an external crust, he states that most substances are denser when cooled to solidification than when fused. In a footnote to p. 40 of the volume of the Transactions of the geological society of Glasgow which contains Sir William Thomson's address, is given a report of later experiments made to test this question by Mr. Joseph Whitley of Leeds, England, who found that iron, copper, brass, whinstone, and granite, the only materials he tested, were all less dense when solid than liquid.

This is not the only instance where men of deserved eminence in their own departments of science, without taking pains to inform themselves in regard to the facts of geology, have sought to teach geologists lessons which they have not themselves fully learned.

Sir Robert Ball, astronomer royal of Ireland, an able and distinguished man, whose merits have been suitably recognized in the office he holds, and the title conferred upon him, in his eloquent address entitled 'Glimpses through the corridors of time,' has proposed a theory, which, if accepted, would not only revolutionize all geological history, but would discredit the teachings of the most eminent geologists. In the circumstances, I have felt called upon to protest against this invasion of our domain, and have shown that the geological record affords conclusive evidence against this theory.

So Mendelieff, one of the most eminent of chemists, has proclaimed the inorganic origin of the Pennsylvania petroleum from an inferred absence of organic matter from which it could be generated. Here, also, I have ventured to show that a better knowledge of the geological structure of western Pennsylvania would have revealed to him the true source of the petroleum in enormous underlying organic deposits, and would have prevented the promulgation of a geological heresy.

Those only are capable of intelligently discussing and deciding these difficult problems in geology, who, with special tastes and abilities, have devoted lives

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[illegible] kind of questions to be [illegible] to the 'Report of the [illegible] published last spring, in which [illegible] session of the International [illegible] invited.

The following are the sub-committees of the [illegible]: archean, Hunt, Hitchcock, [illegible]; lower paleozoic, Hall, Winchell, [illegible]; upper paleozoic, Hall, Lesley, Newberry, Stevenson, Williams; mesozoic, Newberry, Cook, Cope, Powell; cenozoic (marine), Smith, Newberry; cenozoic (interior), Cope; quaternary, recent, archeology, Powell, Winchell, Cook.

PERSIFOR FRAZER, *Secretary*.

Philadelphia, Jan. 22.

## Loco-weed.

In your note on the 'loco weed,' on p. 32 of *Science* for Jan. 14, reference is made to the belief of the Indians that an insect is the cause of the disease supposed to be produced in horses and cattle by eating this weed. In western Kansas there are two plants called 'loco' by the ranchmen. These are Oxytropis lambertii, Pursh, and Astragalus mollissimus, Torr. Specimens of the latter plant were brought to me a few days ago whose lower stems were abundantly occupied by a stalk-boring insect larva. These insects are believed not by Indians but by a certain physician to be the cause of the 'loco' disease in horses by producing 'bots.' Moreover, this physician has frequently seen the horse bot-fly deposit its eggs [illegible] Henceforth let [illegible] the courses of [illegible]

[illegible] Sayre, of the department [illegible] University of Kansas, is [illegible] of the 'loco' problem.

FRANCIS H. SNOW.

## [illegible] and the electric light.

[illegible] or evil appears to be attendant [illegible], and the electric light is not an [illegible] this respect. In this city they have [illegible] positions with a view of illuminating [illegible], notably the treasury, and a fine and [illegible] effect is produced. At the same time, a [illegible] of spider has discovered that game is plenti[illegible] their vicinity, and that he can ply his craft [illegible] day and night. In consequence, their webs are [illegible] thick and numerous that portions of the architectural ornamentation are no longer visible, and when torn down by the wind, or when they fall from decay, the refuse gives a dingy and dirty appearance to every thing it comes in contact with. Not only this, but these adventurers take possession of the portion of the ceiling of any room which receives the illumination.

It would be of interest to know whether this spider is confined to a certain latitude, and at what seasons of the year or temperature we can indulge in our illumination.

G. THOMPSON.

Washington, D.C., Jan. 24.

## A pineal eye in the mesozoic Mammalia.

Among the large number of mesozoic genera which have been determined by Owen, Marsh, and others, only one genus has any considerable portion of the skull preserved. This is Tritylodon, a comparatively large animal from the upper triassic of South Africa, described and figured by Professor Owen in the *Quarterly journal* of the Geological society in 1884. In describing the cranium, he writes (p. 146), "A short anterior divarication [of the parietals] bounds a small vacuity exposing matrix which has filled the cerebral cavity; which vacuity is completed anteriorly by a similar divarication of the mid and hind angles of the frontal bones, the mid suture of which is unobliterated. The above vacuity, *v*, if natural, represents a fontanelle, or it may be interpreted as a pineal or parietal foramen; it may, however, be due to posthumous injury."

Now that the meaning of the pineal gland has been made clear, this observation is of very great interest and importance. Tritylodon is one of a large and widely spread group of mammals, represented by Triglyphus, from the triassic bone-bed near Stuttgart; Bolodon, from the English Purbeck (Jurassic); Allodon, from the American upper Jurassic; and Polymastodon, from the American lowest eocene, or 'Puerco.' From the large size of the parietal foramen in Tritylodon, which greatly exceeds that of any of the recent lizards in relative diameter, and compares with that of the labyrinthodonts and saurians, we may safely infer that the primitive Mammalia, of this family at least, had a pineal eye of some functional size and value.

HENRY F. OSBORN.

Princeton, N.J., Jan. 24.

## Publications received at Editor's Office, Jan. 17-22.

BOUTELLE, C. O. On geodetic reconnaissance. (U. S. coast and geodetic survey, Appendix No. 10.) Washington, Government [13] p. 4°.

DROGISTEN-ZEITUNG. Organ des allgemeinen oesterreichischen Drogistenvereines. Band i. Wien, Stanislaus Mierzinski. 22 p. 4°.

GOODELL, T. D. The Greek in English. New York, Holt. 128 p. 16°. 75 cents.

HEILPRIN, A. The geographical and geological distribution of animals. New York, Appleton. 435 p. 12°.

NEW YORK, department of public instruction. Annual report of the superintendent, 1887. Albany, State. 31 p. 8°.

REMSEN, I. The elements of chemistry. New York, Holt. 272 p. 12°. $1.

SCHOTT, C. A. Magnetic dip and intensity with their secular variation and geographical distribution in the United States. (U. S. coast and geodetic survey, Appendix No. 6.) Washington, Government. [146] p. 4°.

U. S. ARMY, annual report of the chief of engineers of the, 1886. Washington, Government. 393 p. 8°.

—— report of surgeon-general of the, to the secretary of war for the year ending June 30, 1886. Washington, Government. 111 p. 8°.

U. S. MARINE-HOSPITAL service, annual report of the supervising surgeon-general of, for 1886. Washington, Government. 312 p. 8°.

WOODHULL, V. C. The argument for woman's electoral rights. London, G. Norman & son. 202 p. 16°.

## Calendar of Societies.

### *Anthropological society, Washington.*

*Election of officers.* — President, J. W. Powell; vice-presidents, Robert Fletcher, Lester F. Ward Garrick Mallery, Otis T. Mason; general secretary, J. Owen Dorsey; secretary to the council, F. A. Seeley; treasurer, J. H. Gore; curator, John Murdoch; additional members of the council, H. W. Henshaw, W. H. Holmes, H. H. Bates, Frank Baker, Washington Matthews, and Weston Flint.

### *Women's anthropological society, Washington.*

*Jan. 22, election of officers.* — President, Mrs. Tilly E. Stevenson; vice-presidents, Mrs. Lida Nordhoff and Mrs. S. A. Carter; corresponding secretary, Mrs. Eliza Nelson Blair; recording secretary, Mrs. M. O. Clark; treasurer, Mrs. Mary Parke Foster; board of directors, Miss Alice C. Fletcher, Mrs. Clara Bliss Hinds, Mrs. Jean. M. Lander, Mrs. Cornelia E. McDonald, Miss Emma Hammond Ward, Mrs. Melissa A. Bryan.

### *Engineers' club, Philadelphia.*

*Jan. 8.* — Henry R. Cornelius, Two large centrifugal pumps at Mare Island navy-yard, California.

### *Society of arts, Boston.*

*Jan. 27.* — Charles Sooy Smith, Use of the freezing process for excavating in soft materials; George F. Swain, Experimental comparison of some different methods of measuring the flow of water.

### *Engineers' club, St. Louis.*

*Jan. 19.* — H. S. Pritchett, Mexican longitude determinations.

# ANNOUNCEMENT.

During the coming year SCIENCE will publish at least twelve original maps of explorations in different parts of the Earth. The Geographical Department of the paper will be in charge of Dr. Franz Boas, who is well known to many of our readers on account of his explorations and investigations in the regions lying about Baffin's Bay and Vancouver's Island. Dr. Boas has resigned his position with the University of Berlin, and will in the future be permanently associated with SCIENCE.

These maps will be published in the best style possible, and will be furnished in addition to the matter now regularly furnished to our readers. It is expected that this addition to SCIENCE will give to American readers a source of geographical information hitherto unattainable.

In consequence of the time required for preparation, their publication will not be begun until March, after which time they may be looked for at regular intervals.

# PUBLISHER'S NOTICE.

The attention of Subscribers is respectfully called to the following rules of our subscription department:—

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2°. The change of date on address label is a receipt for payment of subscription. No other is given without special request. If the date is not promptly changed after your remittance, please inform us of the delinquency.

3°. The friends of SCIENCE can render valuable aid to the journal by recommending it to possible new subscribers. Recognizing that such assistance is of real value to us, we will, at any time, extend for six months the term of a subscriber who sends us, with the money for one year's subscription, a name not already on our list.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 28, 1887.

## HISTORY OF THE AGASSIZ ASSOCIATION.[1]

As we begin the publication of a magazine devoted to the interests of the Agassiz association, it would seem to be necessary to rehearse to the large circle of acquaintances we now meet for the first time our history and our hopes.

Asking the indulgence, therefore, of our members, to whom the facts are already familiar, we will condense from addresses delivered in Philadelphia and Davenport as succinct an account as possible of the history and aims of our society.

The first hint that ever came to us of the formation of a society for the study of nature is found in one of Jacob Abbott's famous Rollo books,—'Rollo's museum.' Published more than thirty years ago, that little black volume is still as good a guide as any known to me, to put into the hands of young persons who wish to organize themselves into a society. It was a half-conscious recollection of the pleasure I derived from reading this book when a child, that led me more than ten years ago to propose a similar society to the pupils in the Lenox high school.

The proposition was received with enthusiasm. Nearly half the school joined the society, which was first called, I believe, the Lenox high school scientific society. Our work was extremely simple. One boy kept a daily record of the temperature as indicated by a somewhat questionable thermometer; one kept the record of the weather, which was quite laconic, being something like this, "Monday pleasant, Tuesday rain, Wednesday cloudy, Thursday hot, Friday pleasant, Saturday rain." Then we began collecting specimens. I remember one boy collected buds from twenty or thirty different kinds of trees. He got them all on the same day, and, by comparing them, learned something about the times of leaf development.

One expedition was made to study the sections of trees that had been cut down. We wished to find whether the heart is always in the middle of the tree or not. We found it always nearest the coldest and windiest quarter. "Ye see, the wind blows the wood away from the heart," a contemplative rustic explained: thus unconsciously illustrating the tendency of untenable theory to follow in the wake of observed phenomena. With these and other simple observations our little society busied itself, and prospered for several years. At one time there were on my desk about a hundred cocoons of curious form. One of the boys had found what he called 'pea-pods growing on a lilac-bush,' and brought these cocoons all gathered from one tree. Each was enclosed in a lilac-leaf curiously folded around it. At that time I had never seen a cocoon yield up its imprisoned life. One day our school was visited by Mr. George Walton, one of the Massachusetts board of education. It so happened that while he was listening to some recitation or other, I noticed one of the pea-pods acting in a strange manner. It rolled over of its own accord.

I quietly picked it up and handed it to Mr. Walton without a word. While he held it in his hand, there emerged one of those beautiful creatures known as Attacus promethea. It hung down from the dry cocoon by its fore-legs, and slowly expanded its wonderful wings. None of us had seen the bursting of a chrysalis before, and we were all deeply interested and delighted. We then told him of our little society, and showed our other treasures. He urged us to tell our plans to friends about us, and to show them our specimens. So, at a convention of teachers that met soon after, I gave a short account of the matter, and, opening a satchel, covered the table with specimens which had been gathered and prepared by the children. The thing seemed to them so pleasant and so simple and easy to do, that at the close of the meeting no less than fifty teachers crowded around the table to examine the bugs and butterflies, the stones and woods, flowers, ferns, and grasses, and to ask all sorts of questions. Several similar and corresponding societies were formed.

About the same time there appeared in the *New England journal of education* a short article by Count Pourtales (a former pupil of Professor Agassiz) on the subject of school scientific societies. From this article we first learned of the Swiss societies of like nature, and of the boys and girls who wear badges of green fir and go together for frequent field and forest excursions. Thus gradually grew the thought of extending to others what had proved so pleasant to ourselves; and as the *St. Nicholas magazine* had organized, and for a time maintained, a society called 'The bird-defenders,' it was natural to apply to that magazine for space in which to print an invitation to

[1] From the first number of *The Swiss Cross*.

all who might be interested to join us in our work. This request was granted, and the invitation appeared six years ago, and was widely accepted.

The word 'association' was chosen instead of 'society' from an impression, perhaps not entirely well founded, that that word could be taken to mean 'a union of societies,' just as society means 'a union of individuals.' And our first plan was to have these local societies entirely independent of one another, except in the general name and in the purpose of studying nature. At that time no conventions were thought of, assemblies were not in mind, courses of study had not been contemplated, a badge was not designed, nor had we supposed it possible that thorough scientific work could be systematically done by many of the chapters, if at all.

We chose the name 'Agassiz' because it was then uppermost in mind. His then recent death was fresh in the hearts of the nation; and his birth in Switzerland, where a similar organization was said to exist, rendered it especially appropriate. The choice was wiser than we knew. No one can read Mrs. Agassiz's life of her husband without feeling that no name could better stimulate us to faithful work.

Having thus selected the name, a letter was sent to Prof. Alexander Agassiz, asking permission publicly to adopt it. Professor Agassiz replied that he cordially assents that this very pleasant and useful plan for children be called the Agassiz association, and that we have his hearty good wishes for its success.

The societies that joined us during the first year or two of our existence, when our plans were still uncertain and our methods comparatively crude, retain in many cases the notion that the Agassiz association to-day is the same loose organization it was at first, — an aggregation of local societies united only in name, allowed to drift hither and thither without direction or assistance. But the necessity for careful supervision and guidance has grown more and more apparent. We have been constantly besieged with requests for 'systematic courses of study,' elaborate plans of work, personal counsel and advice. Courses of study have accordingly been added, plans of work sketched, and a regular system of reports established. The conditions of admission have been defined, and, in short, more business-like methods adopted, until we now resemble rather an extended school with numerous classes than an ordinary society.

What, then, is the Agassiz association as it appears to-day? And what claims has it upon the interest of the public? It is a union of 986 local societies, each numbering from 4 to 120 members, of all ages from 4 to 84. Our total membership is above ten thousand. We are distributed in all the states and territories with very few exceptions, and have strong branch societies and active members in Canada, England, Ireland, Scotland, Chili, Japan, and Persia.

The 986 local societies are known as 'chapters.' They take their names from the towns where they are established, and are further distinguished by the letters of the alphabet. Thus the first chapter established here was called New York (A); the second, New York (B); and so on.

I may mention four different sorts of chapters. First, family chapters. The parents and children of a single family unite for joint study and research. Chapters of this sort are especially desirable, and prove almost uniformly permanent. Chapters of another sort are found in schools. There are many teachers able and willing to give their strength and time, beyond the exacting requirements of their contracts, to the encouragement and assistance of their pupils. Under the fostering care of such men and women, the happiest results have been accomplished. Not the least important result is seen in the pleasant personal relations thus established between teacher and pupil. Chapters of a third kind are organized and conducted entirely by young persons. A company of girls or boys meet together, and decide to form a branch of the A. A. They elect their officers, draft their rules and by-laws, engage their rooms, build their cabinets, make their collections, prosecute their studies; and, if I needed to awaken interest or arouse enthusiasm, I should have only to show what our girls and boys have done even when unaided and alone. They have made lists of all the flowers that grow about them, and of all the birds that fly over their heads. They have published papers, started museums, founded libraries. In doing this they have mastered the laws of parliamentary debate; have learned to observe with accuracy, to write with fluency, to speak with power; and, after working thus for a few years, many of them have pushed themselves into schools and colleges and laboratories of the highest grade, and are now completing their self-appointed preparation for lives of commanding intelligence and cheerful service. Finally I will mention chapters of adults. In increasing numbers, men and women of mature years, feeling the need of that scientific training which the schools of their childhood failed to give, are organizing societies, joining their influence to our association, and receiving in return the benefits coming from united endeavor and from enthusiastic devotion to a common cause. But, excellent as the work of all these chapters is,

we have found some needed work beyond their individual attainment. A general convention, for example, could hardly be received and cared for by a single chapter; nor could a wide range of local observations be properly collated and discussed by the inhabitants of a single town. It has therefore been deemed wise to bring about the union of all the chapters of a city or a state into more extended organizations than the single chapter. These confederations of chapters are called 'assemblies;' the two most prominent at present being the Philadelphia assembly, and the State assembly of Iowa.

Embracing all the little chapters, binding into one the larger and more powerful assemblies, and making room also for individuals when chapters cannot well be formed, is our Agassiz association. There are 986 chapters, about 6 actual and 40 potential assemblies, but only one association. And the influence and prosperity of each assembly can be increased and perpetuated by spreading everywhere we go a knowledge of our local work not only, and of our local organization, but also, and even with more emphasis, a knowledge of our entire association, with its broader membership and its farther-reaching aims.

Our association is not by any means great or powerful. As yet it is young, it is ignorant, it is weak. We have no occasion for vain-glory. Yet, on the other hand, while we have no excuse for vanity, neither need we feel vexation of spirit. Our purposes are good, our methods right. In spite of our feebleness, in the face of our ignorance, critics have been indulgent, and we have been more encouraged and praised for what we have tried to do than derided for our failures or censured for our faults. Scientific men of highest repute, men like Ramsay of England, and men like Agassiz, Hyatt, Winchell, Remsen, Gould, Gilman, and Scudder of America, have extended to us the hand of recognition.

The press has almost always been indulgent; and, although we have often exposed ourselves to fair attacks of satire, our real desire to do honest work has somehow turned the most caustic pen to kindness.

In speaking of our helpers, I should be unjust if I failed to mention with renewed gratitude and honor the large number of scientists who have voluntarily devoted their valuable time to the cheerful and patient assistance of our needs. More than fifty gentlemen representing all departments of science hold themselves always ready to answer the questions that puzzle us. Thanks to their benevolence, the boy who lives in the remotest and smallest village can send his bit of stone or his curious beetle to one of these men, and learn its name and history, and, better still, be taught how he may best study by himself its structure and its history. Some of these professors have even volunteered to conduct courses of study in various branches. We have had courses in botany, entomology, and mineralogy. The course in mineralogy recently finished by Professor Crosby of Boston has been especially successful. One hundred and forty-four chapters or individuals took this course, and completed it not only to our satisfaction, but to our surprise and delight.

It seems at first thought difficult, if not impossible, to suggest any general principle of study that can apply to the whole association, for it is composed of elements so diverse.

We are of all ages, of varying capacities and differing desires, living in places widely distant and strangely different. Some of us pick our violets in June, others in January.

But there is a common ground on which all stand, — love for nature, and desire to learn. And there is one principle that underlies and determines the methods of our study. It is this: Nature must be studied from her own book.

While, therefore, we do not undervalue the printed records of others' work, and while we ever recognize in printed books and papers necessary and cherished guides, yet we believe that our first business is to meet Nature face to face. Therefore we leave the confines of the library and school, and go out under the open sky, — into the forest, and along the stream.

Forgetting theory and useless wrangling, it is our purpose to see things as they are, and to record them as we see them. It is the business of the Agassiz association to live for the truth.

Many of those who first joined our ranks are growing out of childhood into manhood and womanhood. Many adult chapters, too, are forming; and perhaps to-day one-quarter of our total membership may be over twenty years of age. What can we do for this increasing class? In the first place, we can give them the opportunity to help the younger, even as they themselves have been helped while young. It is to them, the scientists of the future, that we must soon look for special help, instruction, and guidance. Meanwhile we need them still among us to encourage us by their example, and to aid us by their work. And we want to help them too. We must provide higher courses of study, — discover the best books for students more advanced, and help those who need it to secure the best instruction. I was greatly pleased this summer, while resting by the sea, to find in the laboratory at Annisquam, among the twenty-five earnest workers who were bending day after day, and night after night, over the

dissecting-table and the microscope, no less than seven men and women who either are or have been members of the Agassiz association. Here is the moral of it: youthful observation of nature, wisely directed, grows into manly and womanly consecration to science.

Now, one thing our association ought to do in the near future is to secure control of one or more tables in this and other thoroughly equipped laboratories, and place them year by year freely at the disposal of such of our number as may show themselves worthy. May we not in time hope to establish here and there laboratories of our own, manned by our own professors?

We wish also to establish courses of study with greater regularity, and of wider range. I should like to see a yearly correspondence course in each of the branches of natural science, conducted by the best teachers of America. I should wish these courses, specimens included, to be absolutely free; and I should wish the men who give them well paid for their time and work.

At present, as we depend entirely upon volunteers, our courses, though frequent, are rather desultory, and accompanied with some slight expense for specimens and printing. To do all we hope to do will cost much money, and the money must be raised. The Agassiz association must be endowed, and the money will come, as time and devoted labor have long since come. There are plenty of wealthy men and women ready to give money as soon as we can prove that it can be given safely, worthily, and well. Now, here we have a school of more than ten thousand pupils, confined to no one city, no one state, no one denomination. We have a corps of fifty volunteer instructors. We need no expensive buildings. And if we find that in order to meet the needs of our maturing membership we need a fund of ten or twenty or fifty thousand dollars, whose income shall be applied to giving worthy young men and women a chance to work under competent instruction, I have faith to believe that some man will be found deep enough in pocket, and broad enough in heart, to endow the Agassiz association as he might a collegiate chair or a private school. Let each chapter and each member be like Diogenes, ever peering about with lighted lantern to find this man.

But we need not wait for that. There is enough we can do unaided; and, indeed, I am inclined to think that labor voluntarily expended by boys and girls in building their own cabinets, and by girls in decorating and caring for their assembly-rooms, is the cause of the truest satisfaction and enjoyment, and is also productive of the greatest interest in the weightier matters of scientific study. You can see most clearly through a microscope that you have worked and waited for.

If the endowment ought to come, it will come in due time; but in the mean while let each continue to do his best where he happens to be. The way to help the whole association is to give your best attention to your individual work. Let the little ones gather their pebbles and their flowers. Let the elder look more closely into the structure and the habits of bird, or beast, or plant. Let us all be always living for the truth, and striving to read in every leaf of Nature's book her lesson of faith, her lesson of hope, her lesson of love.

Admirably has one of our Iowa chapters united science and humanity. Organized as a society of scientific workers, it has made itself also a band of mercy. It has proved, that, although the eye of Science is keen, her heart need not be cold, and that her hand, however cunning, may yet be kind. Two kindred spirits were Agassiz and Audubon; and very many who, with us, have enrolled themselves under the name 'Agassiz,' have also joined the Audubon society, while many others are learning — regarding birds not only, but every living thing — never needlessly to hurt or to destroy.

But Agassiz was not only merciful: he was devout. Before opening his famous school at Penikese, he bowed his head in silent prayer; and, as the ocean-breeze gently lifted his whitening locks, every head was bowed with reverence, and it seemed as though the Spirit of God were there. We therefore beg our members, as they walk through this fair garden of the Lord (and this thought I echo from the lips of Dr. Parkhurst), not to let the beauty of the creation hide from them the face of the Creator. We do not believe that faith is inconsistent with intelligence, hope at variance with knowledge, or love opposed to science. "The garden of the Lord should not conceal the Lord of the garden." Let us study with the eye not only, but with the heart; and may we all be lifted to a sweet consciousness of Nature's ministrations, the beauty of her handiwork, the music of her singing, and the tenderness of her love.

HARLAN H. BALLARD.

## *A CRITICISM OF PASTEUR.*

AT the meeting of the Paris academy of medicine, Jan. 4, Professor Peter, the well-known antagonist of Pasteur's theory, read a paper concerning a case of death by hydrophobia after preventive inoculations.

It seems that a cart-driver by the name of Réveillac was bitten in the finger some time since by a mad dog. Twenty-four hours after the accident the wound was cauterized; and the next day, fol-

lowing the advice of some friends, the man went to Pasteur to be submitted to his treatment according to the new method, which was explained in a recent 'Paris letter' to *Science*. Matters progressed favorably till the 12th of December (the accident was early in November). On that day Réveillac felt pain, at first slight and afterwards more severe, in the points where the inoculations had been made, while no pain was felt in the bitten finger. This important point was testified to by the patient himself and by the persons who lived with him, and it has been corroborated after careful investigation.

Following this pain were other symptoms, prominent among which was a general feeling of restlessness and great weakness. The weakness was so great, even on the first day, that the patient, on being advised to visit Pasteur and ask for relief, answered that he wished to, but felt utterly unable to do so. The second day the weakness increased, and the patient could hardly eat. He died on the 16th of December. During the last two days of the illness, the attending physicians witnessed symptoms in the throat of an impossibility of swallowing liquids. There were no convulsions, but only weakness and paralysis.

Professor Peter called attention to the facts, first, that the premonitory pain was not in the finger where the original poison had entered, but at the points where the inoculations had been made; second, that the other symptoms had not been those of common rabies, but of experimental hydrophobia. Instead of convulsions, paralysis was the principal symptom.

A discussion followed the reading of the paper, and the objections were made that it was by no means certain that Réveillac had died from rabies, that paralytic rabies is very rare among men, and that many symptoms of that disease were wanting. Professor Peter's criticism is, however, interesting, and is likely to attract attention. It is unfortunate, however, that we have no certain proof that Réveillac died from the inoculations. If care had been taken to inoculate animals from the tissues likely to be most affected in the patient, we should have had a better basis for deciding on the merits of the case.

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## *THE RUBY-MINES OF BURMAH.*

FOR some time past a considerable share of European political and military interest has centred in south-eastern Asia. The fact that in at least one of the countries of that region, Burmah, precious stones are reputed to be found in great quantities, will attract attention of a different order. In view of the report that British troops were about to take possession of the Burmese ruby-mines, a correspondent of the London *Times* has furnished that journal with a description of them and an estimate of their probable value.

It seems that most of our information concerning these mines comes in a more or less amended form, from the account of Tavernier, — information of two hundred years ago, to be sure, but still the basis of all subsequent accounts. He describes the place where the rubies are obtained as "a mountain twelve days' journey or thereabouts from Siren (i.e., Siriam) towards the north-east, and it is called Capelan (i.e., Kyat-pyen). It is the mine whence is obtained the greatest quantity of rubies, spinelles, or mothers of rubies, yellow topazes, blue and white sapphires, hyacinths, amethysts, and other stones of different colours. . . . Siren is the name of the city where the King of Pegu resides, and Ava is the port of the kingdom. From Ava to Siren you ascend the river in large flat boats, and it is a voyage of about sixteen days. You cannot travel by land on account of the forests, which abound with lions, tigers, and elephants. It is one of the poorest countries in the world: nothing comes from it but rubies, and even they are not so abundant as is generally believed, seeing that the value does not exceed 100,000 crowns per annum. Among the multitude of these stones you would find it difficult to meet with one of good quality, weighing three or four carats, because the king does not allow any to be removed till they have been seen by him, and he retains all the good ones which he finds among them."

Two other authorities, men who have visited these mines during this century, are Father D'Amato, who saw the mines about 1830, and a Mr. Bredemeyer, who was in charge of mines in the vicinity about 1868.

Father D'Amato's account is that Kyat-pyen is situated about seventy miles to the north-east of Mandalay. The gem-gravel occurring there was reached by pits of from twenty to thirty feet in depth; but extensive working, owing to the influx of water, was impossible with the primitive methods followed by the miners. Besides rubies, sapphires, topaz, and oriental emeralds were also found, and spinelles were abundant. All stones above a certain weight became the property of the king, provided they were not stolen and smuggled away. Facilities for this were, however, afforded by the visits paid to the mines annually by merchants from China and Tartary.

Still more recent visitors to Mandalay have found that the majority of the rubies found are less than a quarter of a carat in weight, and the larger ones are generally flawed. Sapphires,

though rare, are occasionally found of from nine to thirteen carats in weight and without flaw. The revenue from these mines, which has been a royal monopoly, amounted in 1856 to about fifteen thousand pounds sterling annually.

As to the benefits to accrue to the new owners, the *Times* correspondent is sceptical. He says that to sanguine minds the prospect may appear tempting, and it may be thought that with proper mining appliances, and under British management, these mines might be made to yield a rich return. It may prove to be so, but "experience in India and Ceylon under more favorable circumstances of position does not justify that conclusion."

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### *BRITISH CENTENARIANS.*

THE British medical association assigned to one of its committees the task of inquiring into the medical history of the very aged. In answer to their widely distributed circulars, they have received a large number of records; and, of these, fifty-two cases refer to persons claiming the age of one hundred years or over. The detailed tables with regard to these fifty-two centenarians are published by Professor Humphrey, F.R.S., in a supplement to the *British medical journal* (Dec. 11 and 25, 1886). It is not meant to be implied that all these cases are beyond question: in only eleven cases (two males and nine females) was the age confirmed by baptismal or other records; and in the rest of the cases one can safely say that they were very, very old. It is satisfactory to find that in these tables the well-known pride of longevity and love of exaggeration have not induced any one to claim so high an age as 110: 108 and 106 are the highest ages recorded.

Thirty-six of these fifty-two are women: this excess undoubtedly indicates that females are more apt to reach these extreme ages than men; but it also indicates that females are more apt to lay claim to extreme longevity, and the ratio of 36 to 16 must be discounted accordingly. The average age of females, as well as of males, is slightly over 102 years; 11 were single (of these, 10 were females), 5 were married, and 36 widowed. The average age of marriage for the men was 31 years; for the women, 25 years. The average duration of married life for the former was over 54 years; for the latter, over 33 years. The average number of children was about six: only one male and one female had no children. The centenarian has a tendency to be among the first-born children: in thirty-eight returns his average position is about the second or third child, and in twelve cases is he the first (and in two of these the only) child. Only 3 of 49 spent their lives in affluence; 28 were in comfortable circumstances, and 18 were poor. The returns of their past condition show a remarkable unanimity as regards their health: they are a robust race, and spare as opposed to stout. They are not subject to ailments, as a rule, and show some remarkable cases of recovery in old age. One had epilepsy from 17 to 70 years; another an abscess connected with the spine, a stiff knee from injury at 50, and other troubles; a third had acute bronchitis at 95; and a fourth, paralysis at 90.

The qualities most frequently mentioned in these life-histories are a good family history; a well-made frame of average stature; an equable development of all the organs, including especially a good digestion, ready sleep, keen but not large appetite; retention of the hair and teeth; and little use of stimulants. Their habits, on the whole, show them to be, as a class, early risers, great out-door exercisers, and moderate in all indulgences.

The average height of the males is 5 feet 8¼ inches, and their weight 138 pounds; of the females, 5 feet 3 inches, and their weight 129 pounds. Twenty-two report good hearing, and 34 good sight. Of 35, 28 use glasses, and 4 of the other 7 probably could not read. Fourteen describe themselves as placid in disposition, 8 as irritable, 11 as energetic, 8 as placid and energetic, and 5 as irritable and energetic. Of 46, 29 are reported as possessing average intelligence, 5 have low and 11 high intellects. The memory for recent events is good in 26, bad in 6, and moderate in 7. Similar figures for the memory for past events are 39, 4, and 4, showing the greater tenacity of early associations. One "remembers and will quote a great deal of the Bible;" another could "repeat about one hundred Psalms correctly." Of 45, 7 smoked much, of which 4 were women. The average time of going to bed was 9 o'clock, and of rising 8 o'clock. The average chest girth in inspiration was 36¼ inches in the men, nearly 31 inches for the women; in expiration, 36⅛ inches and 30 inches. The slight differences indicate a weakening of the respiratory activity. The average pulse is 75, and the respiration 24, per minute. Of 42, 24 had no teeth; among 37 cases, there were 144 teeth, of which 63 were in the upper jaw (19 incisors, 8 canines, and 36 molars), and 81 in the lower jaw (23 incisors, 13 canines, and 45 molars). Evidences of debility are, of course, not rare: they occur in half the cases, and are connected with the heart in two cases, with the heart and lungs in 3, heart and urinary organs in 3, with the lungs in 2, with the brain in 3, brain and urinary organs in 1, urinary in 4.

Dr. Humphrey concludes his comments upon these cases with the hopeful consideration that the result of the investigation is found to be that "the means most suited for prolonging life . . . are the means best calculated to turn it to good account and to make it happy."

## *THE MELANESIAN RACES AND LANGUAGES.*

Some of the most perplexing problems of ethnology are encountered in Oceanica. As is well known, this vast island world, stretching eastward from south-eastern Asia far into the Pacific ocean, is commonly divided into five geographical provinces, — Malaisia, or the East Indian archipelago, extending from the Straits of Malacca to New Guinea; Melanesia, comprising New Guinea and the groups east of it to the Fiji Islands; Polynesia, including the islands of the southern and eastern Pacific, from New Zealand to the Hawaiian group; Micronesia, the range of small islands in the North Pacific, east of the Philippines; and Australasia, comprising Australia and Tasmania. The tribes that inhabit these various regions differ in all the traits which are supposed to indicate distinction of race. The Malays are short, with light-brown complexion, straight black hair, and small Siamese features. The Polynesians are tall, of clear yellow hue, with wavy black hair, and handsome, almost European countenances. Of the swarthy Melanesians, some, like the Papuans, are tall, with prominent, aquiline features, and frizzled locks; others, like the Negritos and Samangs, are short, with woolly or tufted hair. The Australians are black or reddish brown, with negroid features and wavy or crispy hair; while south of them the now extinct Tasmanians had similar features and complexion, with completely woolly hair. The question to be decided is, Do all these tribes belong to one race, or to two, or to many? Ethnologists of the highest ability and attainments — Crawford, Pritchard, Huxley, Wallace, Lesson, Von der Gabelentz, Winchell, and many others — have taken part in the discussion, and we seem as far from a definite conclusion as ever.

The latest and perhaps the most valuable contribution yet made to the evidence on this subject is the comprehensive and profound work of the Rev. Dr. Codrington on the Melanesian languages. The materials for the work were gathered during many years of missionary labor spent chiefly on Norfolk Island, in the Melanesian mission-school of the Anglican church. Australasia is not included within the scope of the work, and New Guinea is only noticed in some incidental allusions; but all the groups lying east of that island, and extending from New Ireland southward to New Caledonia, and eastward to Rotuma and the limits of Polynesia, are illustrated by it. No less than thirty-four languages and dialects are carefully described, and are compared with one another and with the idioms of Melanesia and Polynesia, as well as with the language of Madagascar, which, as is well known, belongs to the Malayo-Polynesian family. Dr. Codrington is an Oxford scholar, versed in classical studies, and familiar with the methods and results of philological research. To a student of linguistic science it is no small pleasure to peruse a work in which the laws of the science, as they have been wrought out by the ablest minds in the study of the Indo-European and Semitic tongues, are applied with a happily illuminating effect to the languages of these barbarous tribes.

The first result is to raise considerably our opinion of the quality of the languages, and our estimate of the intellect of those who speak them. The author finds these idioms remarkably copious. Of this fact he gives an interesting illustration from his own experience with one of them, — that of the island of Mota, of which many of the pupils in the Norfolk Island school were natives. "After some twelve years' acquaintance with the language, talking, teaching, and translating," he writes, "and after having acquired, more or less correctly, a considerable vocabulary of Mota words, I began to buy words that I did not know at the rate of a shilling a hundred from the scholars at Norfolk Island. I left off when lists of three thousand words unknown to me had come in. It is certain that elder natives living at Mota use many words hardly known to those who have gone away from their own island as boys, and that the boys had by no means exhausted their stock. I calculate, therefore, that there were probably as many words still to come as would bring up my vocabulary to at least six thousand words. Of these, many, of course, are compound and derivative; but they are distinct words. This concerns a small island, with less than a thousand inhabitants, with whom European intercourse began within the memory of living men." This fulness, it should be added, is not merely in names of objects and actions. Purely abstract terms are common, and are formed by a system of derivation as clear and regular as that of the Greek or the Sanscrit. Thus from *toga* ('to abide') we have *togara* ('behavior') and *togava* ('station'). *Nonom* ('to think') yields *nonomia* ('thought'); and

*The Melanesian languages.* By R. H. Codrington. Oxford, Clarendon pr., 885. 8°. (New York, Macmillan.)

*tape* ('to love') has for its noun *tapeva* ('love'). As Dr. Codrington remarks, "the presence of abstract words like these, among people of whom it is said 'that they are unable to conceive an abstract idea,' is worthy of notice."

A no less important result brought out by this work is the clear proof it presents that all these languages are nearly allied, and that they all belong to the Malayo-Polynesian family. Of this fact, no one who examines the excellent comparative grammar and the extensive vocabularies given in this volume can entertain a doubt. The question at once arises, How shall we explain this singular connection of speech between tribes so widely different in physical traits?

Three explanations have been offered. The first supposes that all these islands were originally occupied by one race, — a yellow or light-brown people, with straight hair, — and that the differences have been caused, in the course of ages, by the slow effects of climate and other natural influences. In this view, Oceanica would be a microcosm, repeating within its limits the ethnological phases which the world at large has displayed on a wider scale. A second theory is that which is favored by Dr. Codrington, and maintained by him with much force of argument and many illustrative facts. He supposes that the whole archipelago was at first occupied by a dark-skinned and woolly-haired people, originally issuing from Asia, and speaking the primitive language from which all these Malayo-Polynesian dialects are derived. At a later day, a light-complexioned race, allied to the Siamese and other nations of south-eastern Asia, entered the islands by slow and gradual migration, took wives from among the Melanesians, adopted their language, and finally, by their inherent and superior vigor, displaced them entirely in many of the islands, and partially in others. This ingenious theory would explain why only one family of languages exists throughout the Melanesian region, if such were the case. It collapses, however, in the presence of some important facts which the learned author has not sufficiently considered. One of these facts is the ascertained existence in New Guinea of several languages radically distinct from those of the Malayan stock. Dr. Codrington himself remarks that three New Guinea vocabularies, furnished to him by Mr. McFarlane of the London mission society, contained no words that he knew; that is, no words of Malaisian origin. These were from south-eastern New Guinea, opposite the Australian coast. In the north-western part of the island, the German missionaries have studied the language of Mafor, near the Bay of Dorey, and have translated portions of the scriptures into it. A careful analysis of this language is given by Prof. F. Müller in his comprehensive work, 'Elements of linguistic science' (*Grundriss der Sprachwissenschaft*). Many words in it, as he points out, are derived from the Malay; but these are clearly modern additions, several of them being actually of Arabic origin. The grammar and the mass of the vocabulary are peculiar. Professor Müller's conclusion is, that the Malay-speaking Melanesians are a mixed race, derived from a mingling of yellow Malaisians with an aboriginal black race. This theory, in a certain way, accords with that of Dr. Codrington; but it differs from it in supposing that the Malayo-Polynesian language belonged originally, not to the black, but to the yellow race.

For this conclusion there is evidence which seems, on philological grounds, to be decisive. The vocabularies show that the Malaisian words which appear in the Melanesian dialects are usually corrupted, distorted, and abridged, having undergone the same fate which the Latin words experienced in the pronunciation of the Celts and Iberians of Gaul, when these barbarians adopted the speech of their Roman conquerors. Thus, the Malaisian *api* or *afi* ('fire') becomes in various Melanesian dialects *av, ev, eu, iei; ika* ('fish') dwindles to *ig, eg, ie; bua* or *fua* ('fruit') is transformed into *vua, hue, we, wi, oi; telinga* ('the ear') assumes the various forms of *teliga, tikga, dole, koroi, kuli, taia*. Similar contractions and corruptions pervade the entire vocabulary. It is clearly as impossible to hold that the fuller Malaisian words are derived from these briefer forms as it would be to suppose that the Latin *factum, pater, canis,* and *oculus* had their originals in the French *fait, père, chien,* and *œil.*

There can be little doubt that the view of Professor Müller is the correct one, and that the Melanesians of whom Dr. Codrington treats are a people of mixed origin, deriving their language mainly from the Malayan race, and their physical traits, in varying proportions, partly from that race, and partly from a negroid race, which is still found, nearly if not quite unmixed, in many parts of New Guinea. It is but just to say that the author puts forth his own theory merely as a suggestion, and does not allow it to influence in any manner his treatment of his subject. Nothing could be more satisfactory than the general method of his work, its lucid style, its precision and completeness. Several good maps afford useful aid to the student. The volume must be ranked among the best of the many valuable acquisitions which ethnological science owes to missionary zeal and scholarship.

H. HALE.

# SCIENCE.

FRIDAY, FEBRUARY 4, 1887.


## COMMENT AND CRITICISM.

THE ANNUAL REPORTS of President Eliot of Harvard always contain suggestive reading for those who are interested in the advance and improvement of teaching, as well as in teaching itself. The constant effort to seek out and put into practice better methods of instruction, or methods more in keeping with the needs of the time, has been pre-eminently a characteristic of the present administration at Harvard. This was well pointed out by President Angell of Michigan in his after-dinner speech at the Harvard celebration last November. He alluded to the debt that all American colleges owe to the old university for the bold spirit of experiment that has led to the recognition of the difference in value between the traditional, customary, and conventional methods, inherited from previous generations, and the new, fresh, original methods, that contribute their share to the advance of the age. Any thing, he said, rather than stagnation in educational matters. Certainly there is no stagnation at Harvard, and the many changes of the last fifteen years seem only to prepare the way for more.

One of the present concerns of the college is naturally to secure good teaching for those who may desire to take entrance examinations in science instead of in one of the classics. It is well, therefore, to note President Eliot's attitude on this question. He says, "A serious difficulty in the way of getting science well taught in secondary schools has been the lack of teachers who knew any thing of inductive reasoning and experimental methods." One reason of this is that "good school methods of teaching the sciences have not yet been elaborated and demonstrated, and it is the first duty of university departments of science to remove at least this obstacle to the introduction of science into schools. . . . Science can never be put on the right footing at the university, so long as it is practically excluded from secondary schools, or is admitted only to be taught in a positively harmful way." This brings to the front as important a matter as has lately been considered in the development of collegiate study, and young men may well consider the opportunity that it will open for them. For the next twenty years, the preparatory schools will show a growth on the side of science-teaching, the like of which has not been seen in this country, and really good teachers of chemistry and physics will be in increasing demand. It will be a fortunate university that shall supply the most of these teachers.

An interesting paragraph of the report relates to the "list of publications of Harvard university and its officers, 1880–1885." "In this list, about three-quarters of the 1,813 entries relate to science, including in that term medicine. Very inaccurate estimates of the relative activity in literary and scientific publications of some leading American universities having of late years obtained currency, and perhaps credit, through the public press, it is permissible to remark in the interests of truth, that it would be discreditable indeed to Harvard university — old and well-equipped as it is — if any other American institution could approach it in the range and volume of its annual literary and scientific publications." The excess of scientific publications over literary would be much reduced if pages instead of titles were counted; for in science a larger number of brief monographs on limited topics can be found than there is any equivalent for in literature.

During the last twenty years, while scientific studies were finding their place in the college elective lists, the Lawrence scientific school, once a leader among its fellows, has been steadily losing in number of scholars, and hence in influence. For some years past it has suffered seriously, simply from being overshadowed by the growing college across the street. Some have thought that this meant a discouragement to science-teaching at Cambridge, but the very reverse is the case. When the school was founded, the college was narrow, and saw no propriety in allowing a wide variety of study to its undergraduates. There was no advanced teaching in physical or natural science in the college till 1871, and ambitious students of these subjects in the earlier years had

to go to the Lawrence school for them, if they came to Cambridge at all. Now the same class of students undoubtedly goes to the college, attractive in so many ways, for its lines of study have been extended to include nearly every thing at first found only in the scientific school, in accordance with what is vaguely termed the 'spirit of the age;' but it should be recognized that this spirit has been strongly guided by just such institutions as the Lawrence school, whose graduates include a large number of prominent and influential men. If success is to be measured by the share taken in the labor of bringing neglected studies into their proper position, the liberality of Abbott Lawrence and James Lawrence has been successful even beyond their hopes.

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In view of these altered relations, President Eliot recommends that the separate organization of the Lawrence scientific school should be discontinued; that the college faculty should be intrusted with the function of recommending to the governing boards candidates for the degree of bachelor of science; and that the academic council of the university should recommend candidates for the graduate degree of civil engineer, the underlying degree being either A.B. or S.B. The Lawrences would still be commemorated in the names of certain professorships, although no longer attached to a separately organized school. The first of these recommendations will, it is to be hoped, commend itself to the authorities concerned; for the separate existence of the school is not sufficiently encouraged by its present circumstances, and is not likely to be by any thing visible in the future. The third recommendation is not of a kind to provoke unfavorable action. It is to the second recommendation that the most interested discussion will turn. If it result in uniting bachelors of science with bachelors of arts in one body of alumni, the preliminary examinations and the undergraduate courses of study being equivalent, it will be one of the great steps in the advancement of scientific education at Harvard college.

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WHAT MAY BE CALLED the official autobiography of the knights of labor is contained in an article by Carroll D. Wright in the current number of the *Quarterly journal of economics*. To be sure, Mr. Wright is not a member of the order; and we have had other accounts of its genesis before, notably that detailed one published in the large work on the labor-question, edited by Mr. George E. McNeill. But we learn from a footnote that Mr. Wright's article was submitted, previous to publication, to several officers and members of the order, and was by them pronounced correct in all statements of fact. It is this that gives the sketch what we have called its official character. Mr. Wright begins by stating that two fundamental ideas underlie all labor organizations, some choosing one, and some the other. The first of these ideas is that of the association of all men of like employment, and on it the mediaeval guilds and the modern trades-unions were founded. The second idea is of broader scope, and takes no account of particular vocations. It seeks to organize all laborers into a single association, and is of later growth than the idea underlying the guilds and trades-unions. On it the celebrated International was founded, and the no less celebrated knights of labor take it as their starting-point. This second idea is both unsound in theory, and is every day proving itself pernicious in practice. It calls for the division of society at large into classes, and arrays the one against the other. As a matter of fact, no such cleavage of society is possible on any but the most superficial reasoning. In this country, where we recognize no aristocracy of birth, and where the industrial organization is democratic to the last degree, the attempt to so divide society is especially foolish and short-sighted. Though it may create uneasiness and disturbance for the time being, it is in the end certain to fail. If by any chance the advocates of the idea in question should succeed in their endeavor to create industrial classes and to array them against each other, the very first conflict would scatter their house of cards in every direction. It would require a very great turning-back of the wheels of progress to make it possible for the American idea of individual liberty and personal responsibility to be overcome by the ancient and discarded idea of corporate action and corporate responsibility.

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With the various stages in the development of the knights of labor we are already fairly familiar, but Mr. Wright puts the facts again before us in a very clear and connected way. We learn how the personal character and history of Uriah S. Stephens, the founder of the order, impressed themselves upon its early organization, and how the order struggled along from its inception in

Philadelphia on Thanksgiving day, 1869, until the general assembly at Detroit in 1881 freed it from many of the restrictions placed upon it by Mr. Stephens, and made it so popular with certain sections of the people that since that time its growth has been phenomenal in the history of labor organizations. Mr. Stephens's controlling ideas seem to have been two, — first, that surplus labor always keeps wages down (it does not seem to have occurred to him that improving the quality of labor will cause wages to rise); and, second, that nothing can remedy this evil but a purely and deeply secret organization, based upon a plan that shall teach, or rather inculcate, organization, and at the same time educate its membership to one set of ideas ultimately subversive of the present wages system. The history of the knights of labor themselves, and the action of the general assembly at Detroit, are sufficient comments on this second principle. The order grew slowly at first, and, as time passed, the district, and finally the general assembly, were evolved to perfect and unify the organization of the local assembly. The first district assembly was organized in 1873, and the first general assembly met on New Year's day, 1878, at Reading. Mr. Wright notices the various general assembly meetings at Reading, St. Louis, Chicago, Pittsburg, Detroit, New York, Cincinnati, Philadelphia, Hamilton, Cleveland (a special meeting), and Richmond, and characterizes briefly the action taken at each. As to the strength of the order, he cites Mr. Powderly's testimony before the congressional committee in May, 1886, that it then numbered 500,000 members. At the time of the Richmond meeting last October, there were one hundred and sixty district assemblies and about nine thousand local assemblies. The total membership was then about 730,000. Mr. Wright believes that it is to-day about one million.

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Mr. Wright mixes very little criticism or comment with his recital of facts, and we trust it is only because he wishes to avoid any appearance of discourtesy to those who have materially assisted him in collating his data. For, as to the attitude of sound and enlightened public opinion towards the knights of labor, there can be but one opinion. That there was a wide-spread sympathy with the organization and its aims at one time cannot be denied; and it is just as incontestable that this sympathy has been turned into disappointment and disgust by the excesses of the various organizations, and the abuse they have made of their power. Without this sympathy and the support of public opinion, no great movement, labor or other, can be carried to a successful consummation. The spectacle of half a million or even a million men arrogating to themselves the title and privileges of laborers to the exclusion of the other sixteen or seventeen millions of wage-earners in the country, is ludicrous enough; but it becomes supremely so when this small minority endeavors to prevent any of the majority from obtaining such employment as the latter may desire, at such wages as they are willing to accept. It is this general principle, quite as much as the various excesses that have been committed, that has disgusted thoughtful men with the whole movement. The cowardice of political leaders, and the miscalled philanthropy of various members of the community, have permitted things which, without them, no organization would have thought of undertaking, much less of prosecuting successfully.

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There is no subject which has for the sanitarian more interest than that connected with the great mortality among the young children of our large cities. And as the principal factor in this mortality is represented by the term 'summer diarrhoea,' it is to diseases of this nature that especial attention is devoted by those who have at heart the welfare of the young. Thirty-five hundred persons succumbed to this class of diseases during the past year in New York City alone, more than half of the number in the two months of July and August. To diminish this mortality is a task worthy of the best efforts of the philanthropist; and every contribution to this end, however insignificant, should be gladly welcomed, and made, so far as it can be, the basis for action. Dr. L. Emmett Holt of New York, in a paper recently read before the New York academy of medicine, has made a very valuable addition to our knowledge of the causes at work in the production of summer diarrhoea, and to the methods for its treatment. After a full discussion of these points, he presents the following conclusions: 1. Summer diarrhoea is not to be regarded as a disease depending upon a single morbific agent; 2. The remote causes are many, and include heat, mode of feeding, surroundings, dentition, and many other factors; 3. The immediate cause is

the putrefactive changes which take place in the stomach and bowels in food not digested, which changes are often begun outside the body; 4. These products may act as systemic poisons, or the particles may cause local irritation and inflammation of the intestine. In the treatment of the affection, Dr. Holt believes that antiseptics are of great value, especially naphthalin and the salts of salicylic acid.

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THERE SEEMS TO BE a disposition, on the part of congress, to transfer the signal service bureau to the new department of agriculture and labor. General Sheridan approves this plan, and says, that, as a school of instruction, the bureau is not needed in the army, and would prove rather an encumbrance than an advantage: while, so far as its meteorological observations are concerned, these relate wholly to the interests of agriculture and commerce, and should be under the direction of some civil branch officer of the government.

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PROF. WILLIAM JAMES of Harvard has a very clear description of the laws of habit, in the current issue of the *Popular science monthly*, that is at once scientific and philosophical. The old-fashioned literary treatment of habits is as far removed as possible from the point of view and method of Professor James. He shows us that 'habit' is a term of very wide application, and that the phenomena of habit in living beings are due to the plasticity — which means the possession of a structure weak enough to yield to an influence, but strong enough not to yield all at once — of the organic materials of which their bodies are composed. Thus a full account of habits implies some reference to physics as well as to physiology and psychology. Tracing briefly, then, the physiological and psychological side of habits, Professor James passes to the ethical and pedagogical considerations which concern them. He calls habit the 'fly-wheel of society, its most precious conservative agent,' and claims that "it is well for the world that in most of us, by the age of thirty, the character has set like plaster, and will never soften again."

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The decade between twenty and thirty is found to be the critical one in the formation of intellectual and professional habits, while the period of life before twenty is the most important for the fixing of personal habits. From this it follows easily that by education we must seek "to make automatic and habitual, as early as possible, as many useful actions as we can," and, conversely, to prevent the dropping into injurious habits. Professor James shows how unconsciously habits of mind are formed through the process of our daily routine, until some day we awake to the fact that we have acquired peculiar power or skill in some direction. The constant preaching of this truth would infuse new hope and ambition into many desponding workers.

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THE EXCITEMENT AND ALARM which prevailed in this country last year and the previous one, in anticipation of cholera, have entirely subsided, and yet perhaps the danger of its appearance is as great to-day as it has been at any time in the past three years. Although frequent reference to its presence in Europe has been made in the daily press, its ravages have not been described as fully as the facts warrant. At Budapest there have been 1,329 cases with 586 deaths; at Fiume, 260 cases and 161 deaths; at Trieste, 896 cases and 557 deaths. In Japan during 1886 there were 153,930 cases, of which 100,492 were fatal. In Yokohama alone the cases numbered 3,021, and the deaths 2,273. In South America, cholera still exists at Montevideo and Mendoza; the U.S. consul, under date of Jan. 19, reporting that it has been officially declared at the former place. The disease still exists at Buenos Ayres, though it is said to be diminishing and of a less virulent form than heretofore. The presence of cholera on the west coast of South America, which has been announced by the press, still lacks official confirmation.

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## *YOUTHFULNESS IN SCIENCE.*

EVERY college instructor knows only too well how the more active-minded students are eager to grapple with the mightiest subjects, all in the untested pride of developing intelligence. Their themes are, 'The progress of democracy,' 'The comparison of French and English literature,' 'Solar energy,' 'The Darwinian theory,' 'The origin of mind;' in short, all the vastest problems, such as a lifetime is inadequate for. Most of us can gather from our personal recollections some examples of the foible. Youth does not know its measure. Only maturity, and not always even maturity, realizes how tiny and feeble is the force of the individual when it turns to attack the world problems, which stand more mysteriously

and longer than the sphinx to perplex and baffle humanity. The adolescent mind is confident; for it has never been beaten, since it has never been engaged in any real fighting. It proudly believes in its own success, and is but too apt to look disdainfully on great thinkers, because they left more to be thought. It glories in generalizations, and is gladly indifferent to the harassing details and preliminaries, with which, if it continues active, it will afterwards be chiefly and sensibly occupied.

The *young* man is often a would-be revolutionist. He is surprised that older and wiser and better men are so benighted. Let us not be misunderstood. The young man we are characterizing is the one in whom the faults his years are prone to are strongly accented. We have no intention of wholesale condemnation towards a class to which we have belonged, and therefore may be supposed to think of respectfully. If the unfortunate individual or type we are discussing betakes himself to science, he may do useful and praiseworthy work, but he is pretty sure to injure its meritorious part by adjuncts of misshapen generalization, and of criticisms very bad in taste and unjust in substance. His pages show a saddening spectacle of overgrown self-confidence, betrayed by the tone of expression, by the ill-repressed laudation of his own theories, and the bad-mannered fault-finding with others, perhaps merely because their observations, without which the young man could have done nothing, were not exhaustive of the field. Next follows pitiless criticism; the pedestal of flimsy logic is dashed away; the victim falls from his eminence. The specious argumentation is reft, and the man's ignorance is exposed nakedly. Last comes the cruel abasement, all the worse to bear because it is the public sequel of elation. And still the young man must be grateful if the late lesson can be learned by his aching and repentant mind. Would that the fire of the soul always purified, and never consumed!

## *PROHIBITION.*

INTERFERENCE with the voluntary actions of people is to be deprecated, except when such actions trespass on the rights of other members of the community.

A chemical factory, emitting noisome fumes, must not be established in the midst of a town or city, or measures must be enforced against it to prevent the contamination of the surrounding air; a boiler-factory, with its din of rivet-hammering, must not be suffered to disturb the peace of a residential neighborhood; a gunpowder-factory must not be allowed to endanger other properties by its proximity; a graveyard must be kept away from centres of living population. These interferences with the voluntary actions of factory and graveyard owners are justified by the fact that the interdicted operations are trespasses on the rights, because baneful to the health or comfort, of the community.

Is there any similar justification for the prohibition of the manufacture or sale of alcoholic liquors?

We know that use is very apt to degenerate into abuse of such commodities; and we know that more than half of the immorality that afflicts society, and of the crime that fills our prisons, is directly traceable to the abuse of alcoholic liquors. We know also that the heaviest portion of the burdens on tax-payers — the cost of protective, detective, judicial, reformatory, and punitive establishments — is largely owing to the same cause. Everybody admits, therefore, that society would be justified in doing whatever is requisite to protect itself from the gigantic evils which spring from the liquor traffic.

Here, however, the policy now widely advocated diverges from the line of justifiable interference. Prohibition of manufacture or sale is not the proper protective policy. This interferes with the voluntary action equally of those who innocently use as of those who criminally abuse. No notice need be taken of the bigot theory, that innocent use of alcoholic liquors is impossible. Let us grant a place in the world for every thing to be found in it, and for every production of man's hands. Use and abuse are possible for all things.

What, then, is the proper line of social action? Society does not, and can not, prevent the playing of games of chance by those who choose to waste their time and means in such demoralizing pursuits; but society does interfere with the business of the gambler, the card-sharper, the lottery-ticket seller, etc. Society does not seek to stop, by futile prohibitory measures, the prevalence of other forms of 'social evil,' but society does prevent the flaunting of immorality before the public eye, and the use of the streets for its advertising purposes.

So in reference to the liquor traffic. No attempt need be made, or should be made, to interfere with manufacture or sale; but the most absolute prohibition should be laid on the *business* of selling liquor 'to be drunk on the premises.' Saloons and bar-rooms are evil, and only evil, and that continually.

If a man wants beer or brandy, let him buy it as he does beef or bread, and by due measure of

pint or gallon, as he does solid provisions by ounce or pound. And let his purchases of liquor be delivered at his home, as openly as his meat and vegetables are. What would be thought of the man who should pack his fill of beefsteak and oysters within his own waistcoat, and leave his family to dine, as best they could, on bare potatoes? If the beer is good for the husband, a little of it would be equally good for the wife?

No articles of consumption are so tampered with by deleterious adulterations as the staples of the bar-room. No articles are sold at such a disproportion between the wholesale cost and the retail price. Nothing measured by the yard or weighed by the pound is so vague in quantity as the saloon 'glass.' People sneak behind the lattice-screen, and submit to the extortionate dishonesty for the sake of the privacy of their selfish indulgence. In the higher order of such places the patrons are further attracted by objects of luxury and sensuality. Gas, gilding, mirrors, statuary, and paintings are lavished on the surroundings. The wretched tippler's home is, of course, dull in comparison with this brilliant vestibule to the temple of vice.

Prohibition and local option are the measures most widely recommended for the cure of the drink-habit. But the true remedy has not been thought of by the advocates of these worse than ineffective panaceas. The social curse can only be stopped by stopping the liquor-supply at the point where alone it is capable of legislative control. Shut the saloons. Allow no liquor to be sold anywhere to be drunk on the premises. This is the grand summary of a grand revolution.

This 'prohibition' leaves to every man the due exercise of his personal freedom: it prohibits only the manufacture of drunkards, paupers, tramps, and criminals.

The spiders who fatten on the weak frequenters of their glittering nets of doom would have to turn to other employments. *They* would not be the liquor-sellers of the future. These would be of the class of ordinary honest tradesmen who put a fair price per definite quantity on a definite quality of their wares. Purchasers would be protected as to quality by certified inspection, and as to quantity by the compulsory use of measures in selling. Cut away by these provisions, the source of dishonest profits from the business of the bar-room, and even the proprietors of such establishments would speedily relinquish the traffic.

Prohibition of the *use* of alcoholic liquors has never succeeded — never can succeed; for it is a tyranny from which every independent mind revolts. If a man will play the fool with his brains and his means, society cannot stop him; but it ought not through its licensed agents to facilitate the process. It should, moreover, provide an easy means of family protection from the consequences of drunkenness. Legislation can accomplish this, and nothing more would be necessary.

To stop the sale of alcoholic liquors for consumption on the premises would inconvenience nobody. Phials of any capacity might be obtained for use at home. And the gilding and glitter of the saloon might still be available to render attractive the tea-room, coffee-room, and reading-room, where families as well as individuals might resort for the cup 'which cheers but not inebriates.'

B.

## *PETER'S ATTACK ON PASTEUR.*

THE discussion in the Paris academy of medicine, which originated in Professor Peter's recent paper on death by hydrophobia after preventive inoculation, was concluded at the last meeting (Jan. 18). Professor Peter spoke again upon the subject, but in much milder language, and his remarks may be summarized as follows: —

When death takes place after preventive inoculation, the defenders of Pasteurism recur to an alibi or to extenuating circumstances instead of confessing the truth. For instance, they argue that death was due to some other cause, such as uraemia, meningitis, or albuminuria, but not to hydrophobia. In other cases they admit that hydrophobia is the cause of death, but they explain it by stating that the patient did not apply for treatment until it was too late. M. Peter does not accept these excuses, and bluntly says, that, if patients die after having submitted to preventive inoculation, their death is due to the inoculation, entirely ignoring the effects of the rabid animal's bite. Pasteur's method, according to M. Peter, is an ingenious one; but it should not be applied to man, especially the more recent method of intensive inoculation. The old method, he admits, is harmless though useless; the new method, he claims, is harmful, even murderous. To it and not to the bites of the rabid animals, he attributes the recent death of patients with hydrophobic symptoms, after preventive inoculation.

M. Brouardel, in a short matter-of-fact address, said that M. Peter's arguments were utterly illogical, and concluded by giving the statistics of results already achieved at Odessa, as follows: out of 101 cases treated by the ordinary method, there were 7 deaths; out of 35 cases treated by the mixed method, 1 death; out of 140 cases treated by the intensive method, *not one death*. This disposed of the charge that the latter method is mur-

derous. M. Vulpian stated that out of 136 cases of bites inflicted in the face by animals known to be rabid, treated by the ordinary method, there were 10 deaths; out of 50 similar cases treated by the intensive method, *no deaths*. As to the charge that the method is useless, that is refuted by statistics already familiar to those interested in the subject.

M. Vulpian spoke at some length on the possibility of encountering the paralytic form of hydrophobia in man under ordinary conditions, mentioning some cases which prove that it does sometimes exist where the person bitten by rabid animals has not been subjected to preventive inoculation.

The discussion is ended for the present, but it will doubtless begin agein at some future time. Though M. Peter was somewhat moderate in his remarks at the last meeting of the academy, he does not seem to possess the spirit of scientific criticism, perceiving neither the weight of the arguments advanced in opposition to his assertions nor the fallacy of some of his own.

As M. Pasteur has been accused, though wrongfully, of concealing the results of his treatment, it has been decided to publish statistics monthly, instead of quarterly as heretofore. They will appear in the *Annales de l' institut Pasteur*, which will be published under the direction of M. Duclaux.

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## *ST. PETERSBURG LETTER.*

THE geographical event of the season is the return of Potanin, who is expected here in time to attend the annual meeting of the Russian geographical society this month. A large map of the route travelled by him is being prepared by Colonel Bolschew, the military cartographer. The previous travels of Potanin were especially noteworthy on account of his ethnological and anthropological studies; but the chief importance of the expedition from which he now returns lies in the geographical studies made by him in the higher parts of Asia, not only because he has visited regions heretofore untrodden by civilized man, but also because of the accuracy of his observations in those regions. The latitude and longitude of sixty different points have been ascertained, and the barometrical observations of the expedition will permit of a tolerably accurate determination of heights. There were 4,500 versts of accurate survey made, and this in the parts least known, while in the more thickly settled regions approximate surveys only were found possible. The co-operation as topographer of Skassi, who accompanied Severtzow on many of his travels, contributed much to these results. The travellers were exceedingly well received by the Chinese authorities, who furnished them with guides and all necessary information. The most important work was done on the journey from Koko-Nor directly north to Kiachta by way of the Gobi desert. The river Ersin-Göl was followed over a great part of its course to the point where it falls into Lake Soyok-Norinto. Farther northward four ranges of mountains were found.

The second in importance of the Russian scientific expeditions of the past year was the so-called Chan-Tengri expedition, headed by Ignatiew, who visited the glaciers of that mountain. The results of the expedition are not yet made public. He travelled through the Muzart pass, and found it to be as difficult of access as it was generally believed to be. The botanist Krasnow took a more easterly road, and, traversing the Bedel pass, went to Utsch-Turfan. Much is to be expected from the latest work of this young naturalist, if we may judge by what he has already accomplished.

The secretary of the Geographical society, A. W. Grigoriew, recently attempted to visit the Solovetz Islands in the White Sea, desiring to make observations on the depth and temperature of the waters there, but, as he could find no ship to transport him thither, did not succeed in reaching the islands. He made an excursion, however, to the waterfalls of Kiwatsch and Por-Porog, from Petrozavodsk on Lake Onega. The position of the latter waterfall, as well as of its river, is not shown on any map as yet. There is a great lack of astronomically determined points and of accurate surveys in that part of Russia, and there is but little hope of any thing being accomplished there at present by the military surveyors. It would be a good field for private enterprise, as the region may be easily reached from St. Petersburg by means of the steamers plying on Lakes Ladoga and Onega. It is a picturesque country, with numerous lakes and waterfalls, and affords excellent salmon and trout fishing.

Some new data on the topography of the country between Vologda and Archangel were obtained during the past summer by Kusnezow. The greatest elevation on the watershed between the Volga and the Dwina was found to be 756 feet. Thus the topographical work of Russia is slowly advancing.

The Geographical society has under consideration some short practical instructions to explorers, the main point aimed at being to draw their attention to the alleged gradual drying-up of the inland waters of the Asiatic continent. It has already been mentioned that Jadrinzew, on comparing last-century maps with those of recent years, finds that the lakes of the Baraba steppe,

such as Tschany, for instance, have shrunk to half their former dimensions. On personal examination of those lakes, he found many traces of a recent decrease in their waters. Russia has so many lakes, that the study of their physical geography is especially important.

The pendulum ordered last year has been brought from Hamburg to St. Petersburg by Professor Lenz. It has been carefully tested, and Professor Bredichin, the astronomer, will make determinations of gravity with it next summer in the vicinity of Moscow.

Among the recent changes in the *personnel* of the Geographical society, the following may be mentioned: General Stebnitzky has been chosen president of the mathematical section, and Prof. W. Lamansky of the ethnographical section. The former is known by his excellent geodetical work in the Caucasus and the eastern part of Asia Minor, and also by his works on local attraction. The latter gentleman is one of our most eminent Slavists.

The eclipse of Aug. 19 will be visible over a great extent of Russian territory. The question as to the best methods of its observation, which was discussed last spring by the Physico-chemical society, is now being considered by the Meteorological commission of the Geographical society, which will occupy itself mainly with observations on pressure and temperature during the eclipse. It has not been decided what expeditions will be equipped for the purpose, and only two points of observation have as yet been determined upon. One or two astronomers will be stationed on the estate of General Maiewsky, in the district of Tver, where an astronomical observatory is established; and Professor Bredichin, with two English friends, will take observations on his estate in the government of Kostroma. It is not as yet known whether or not the Pulkowa observatory will send out a party. The visibility of the eclipse on land will be unusually great; and the country west of Lake Baikal, where the totality will be seen, is tolerably well settled; and to Tomsk, at least, the railroad and steamboat communications are good. The time of the year is favorable, and the hour, 7 A.M., is such that the morning fogs will have been dissipated.

The question as to the new chair of geography in the Russian universities is under discussion. The universities of Moscow, Kharkow, Kasan, and Odessa have already sent their opinions to the ministry of public instruction, that of St. Petersburg is still considering the subject, while Prof. A. Woeikof has been sent to different countries of Europe on a scientific mission in connection with the matter.

The Academy of sciences has recently elected to membership two chemists and a mathematician. The former, Professor Beketow, of Khartow, and Professor Beilstein of the Technological institute of St. Petersburg, are well known abroad; the latter, Dr. Marcow, of St. Petersburg, is a young man of great talent, who occupied the chair of Professor Tschebischew after the latter left the university.

Among recent scientific publications may be mentioned that of M. A. Rykatschew on the freezing and opening of rivers and lakes in Russia. The author, with the assistance of three naval officers, — Kowalsky, Maliarewsky, and Filenius, — has collected a great quantity of material which he has used in a very able manner. For the dates of opening of the rivers, lakes, etc., he has availed himself of observations at 907 different points, and, for those of their freezing, 890 points. Some of these observations extended over long periods, those relating to the Neva at St. Petersburg, Vistula at Warsaw, Dwina at Archangel, Angara at Irkutsk, Düna at Riga, and Küro at Storküro, reaching back over a hundred years; the Onega at Onega, Bielaya at Ufa, Volga at Saratov, Obi at Barnaul, Sookhona at Ustiug-Weliki, Sysola at Ust-Sysolsk, and Yenisei at Yeniseisk, more than eighty years. The following table shows the number of available observations as to time of opening and freezing at the points mentioned during the number of years given in the first column: —

| | Opening. | Freezing. |
|---|---|---|
| 80 years or more | 13 | 11 |
| 50 to 79 years. | 14 | 10 |
| 30 " 49 " | 39 | 30 |
| 20 " 29 " | 136 | 119 |
| 10 " 19 " | 241 | 239 |
| Less than 10 years. | 464 | 408 |

In the book under consideration the observations for each year are given separately. The results are also graphically shown by three charts or diagrams, — one for the date of opening, one for that of freezing, and one for the number of days the rivers are frozen. As might be expected, there is nearly always a retardation; that is, the rivers do not freeze over until some days after the temperature has fallen below 0°, and do not open until some days after it has risen above 0°. This retardation is greater for large rivers than for small ones. The explanation of this difference is, that a longer time is required to chill a large body of water than a smaller one; and, on the other hand, the melting of the snow, and the consequent snow-water, sooner affects the ice of a small river than that of a larger one. But

when once begun, the thawing and breaking-up of the ice on a large river proceed more rapidly than on a smaller one. This retardation is greater on the Volga than on any other river in Russia. On the major part of its middle and lower course it remains unfrozen for more than thirty days after the temperature has fallen below 0°, and it does not open in the spring until at least fifteen days after the temperature rises to that point.

To-day, at the yearly meeting of the Academy of sciences, a commemorative gold medal was presented to Gen. N. M. Prjevalsky. O. E.

St. Petersburg, Jan. 10.

## NOTES AND NEWS.

AT the last meeting of the board of regents, two assistant secretaries were appointed to aid the secretary in the work of the Smithsonian institution. Prof. S. P. Langley of Alleghany City, Penn., was appointed as assistant secretary in charge of exchanges, publications, and the library; and Prof. G. Brown Goode, as assistant secretary in charge of the national museum.

— The Cincinnati society of natural history presents an unusually attractive course of free popular scientific lectures the present season. This is the sixth course, and the subjects are as follows: 'Climate, plant-life, and consumption,' Dr. W. A. Dun; 'Deep-sea explorations,' Joseph F. James; 'The moon,' J. G. Porter; 'The retreat of the ice and the evolution of Lake Erie,' E. W. Claypole; 'The U. S. fish commission,' Herbert Jenney; 'Forestry,' R. H. Warder; 'Sun-spots,' Amos R. Wells; 'Gas as a fuel,' N. W. Lord; 'Glaciers and earthquakes,' J. W. Hall; 'Primeval man,' E. D. Cope; 'Bird-life,' F. W. Langdon. The first lecture was given on Jan. 14, and the others follow at intervals of one week. The society is unusually active this year, and is in a prosperous condition. A lyceum for young people has been inaugurated, and ninety names are now enrolled. The object is to interest children in the study of natural history, and there is every reason to believe the plan will succeed. In addition to these, a course of lectures on physiology, by Dr. C. E. Caldwell, to the school-teachers, is being given. Sixty have been enrolled, and each lecture has been well attended.

— The recent election in the California academy of sciences held in San Francisco resulted in the election of the following officers: president, H. W. Harkness; first vice-president, H. H. Behr; second vice-president, G. Hewston; corresponding secretary, H. Ferrer: recording secretary, Charles G. Yale; treasurer, John Dalber; librarian, Carlos Troyer: director of the museum, J. C. Cooper; trustees, Charles S. Crocker, T. P. Madden, J. M. McDonald, E. L. G. Steele, S. W. Holladay, Dr. Hayes, and E. J. Molera. Prof. George Davidson, who had been president of the academy for fifteen years, was not re-elected. By the will of the late James Lick, the academy will receive two hundred thousand dollars, a portion of which will be devoted to the erection of a new building.

— Consul Bissinger, at Beirut, in a recent report to the department of state, says that the preliminary and experimental borings in the extensive oil regions on the littoral of the Red Sea are being pushed forward with unabated vigor by the Egyptian government. An efficient staff of geologists, mining engineers, and other experts from the United States, Great Britain, and Belgium, are busily at work, ably seconded by experienced assistants from the American and Russian oil-fields. Improved machinery and mechanical appliances of every description have recently been landed at the newly constructed harbor situated about two miles north-north-east of the petroleum wells. These wells are pools of a black-looking, bitumen-like substance, which emit an unmistakable odor, and scent the desert air for miles around. The whole district, from Gemsah in the south to over twenty miles north of Djebel Teyt, presents every indication of the presence of oil; and when it is remembered that oil was 'struck' at a moderate depth at the first boring, and a 'flowing well' was produced at a greater depth at a subsequent boring, there is every reason, it is claimed by those having devoted much time and thought to the subject, to believe that the fields contain petroleum deposits in such abundance as to fully justify the immense expenditures ventured in the elaborate preliminary operations by the Egyptian government. A more recent report announces that well No. 1, at Gemsah, is now spouting pure, heavy petroleum at a depth of 125 feet.

— The house library committee has made a favorable report on the resolution providing for a joint committee of five senators and eight members to consider the expediency of holding, in 1892, an international exhibition of the industries and products of all nations, to be held at Washington in 1892, to commemorate the four hundredth anniversary of the discovery of America.

— An amendment will be added to the sundry civil bill in the senate, constituting the secretary of state, the secretary of the Smithsonian institution, and the librarian of congress, a com-

mission to report to congress the character and value of the historical and other manuscripts belonging to the government, and what method and policy should be pursued in regard to editing them.

— The Yellowstone park bill was passed by the senate last week. It defines the park boundaries, places it under the exclusive jurisdiction of the United States, and sets the territory apart as a public park and pleasure-ground for the benefit of the people. The secretary of the interior is authorized to make rules for the management and care of the park, and provision is made for a detail of troops to protect its beauties. All hunting of wild animals or birds, except animals dangerous to human life, fishing with nets or traps, is prohibited, and violations are punished by fine and imprisonment. The President is to appoint a commissioner, who is to reside in the park, and act as a justice of the peace in placing offenders within the jurisdiction of a district court.

— One of the most complete and most valuable collections of Indian folk-lore yet published is the volume of 'Indian traditions of north-western Canada' (*Traditions Indiennes du Canada Nord-west*), which has just appeared in the series of '*Les littératures populaires de toutes les nations*' (Paris, Maissonneuve Frères et Ch. Leclerc). The author, the Rev. Emile Petitot, who was for twenty years a missionary among the tribes of the far north, is well known to scholars by his excellent comparative grammar and dictionary of the Dènè-Dindjiè dialects, and by many other useful works on the philology and ethnography of northern America. The present collection is chiefly devoted to the legends and traditions of the far-spread Athabascan tribes — styled Dènè-Dindjiè by the author — occupying the vast region between the Eskimo of the northern coasts and the Algonquin and Dakota tribes of the Red River and Saskatchewan countries on the south. The stories are given in the bald simplicity of a literal version, with no attempt at literary garnishing, — a fact made clear by the addition, in some cases, of the original, with an interlinear translation. Even in this rude guise, evidence of no small imaginative power is frequently apparent. What is chiefly remarkable is that (with a very few exceptions) these Athabascan legends differ totally, in their incidents and their mythology, from the folk-tales of their neighbors, — the Eskimo on the one side, and the Algonquin and Dakota tribes on the other. The exceptions are in a few of the stories of the more southern tribes, which differ widely from the rest, and are clearly borrowed from the Algonquin Crees. This distinct character of the Athabascan legends confirms the fact, which has been noticed by Major Powell and other careful observers, that the Indians of each linguistic family have their own special mythology, different from all others, — a fact certainly of great and far-reaching importance in ethnological science. M. Petitot has some fanciful theories about a connection between the Indians and the ten tribes of Israel, and also — what seems rather inconsistent — about the reference of some of the legends to the glacial era, the change in the earth's axis, and other primeval events. As in the case of that learned and estimable but somewhat visionary writer, the late Abbé Brasseur de Bourbourg, — of whom our author much reminds us, — readers can accept the valuable facts which he honestly gives them, without troubling themselves about his peculiar hypotheses.

— Following the monograph on 'Co-operation in a western city,' by Albert Shaw, Ph.D., the American economic association announces the publication of a history of 'Co-operation in New England,' by Edward W. Bemis, Ph.D., to be issued Feb. 5. Dr. Bemis has made a study of co-operation, and this work will be a guide for co-operators, and contain many facts to interest the student of the labor problem. Copies may be had of Dr. Richard T. Ely, secretary, Johns Hopkins university, Baltimore, Md.

— Mr. G. W. Hill of the Nautical almanac office, Washington, was awarded the gold medal of the Royal astronomical society, at the December meeting, for his laborious and masterly researches upon the 'Lunar theory.'

— The Royal society of New South Wales offers its medal and a money prize for the best communication (provided it be of sufficient merit) containing the results of original research or observation upon each of the following subjects: — Series vi. (to be sent in not later than May 1, 1887): No. 20, 'On the silver-ore deposits of New South Wales,' the society's medal and £25; No. 21, 'Origin and mode of occurrence of gold-bearing veins and of the associated minerals,' the society's medal and £25; No. 22, 'Influence of the Australian climate in producing modifications of diseases,' the society's medal and £25: No. 23, 'On the Infusoria peculiar to Australia,' the society's medal and £25. Series vii. (to be sent in not later than May 1, 1888): No. 24, 'Anatomy and life-history of the Echidna and Platypus,' the society's medal and £25; No. 25, 'Anatomy and life-history of Mollusca peculiar to Australia,' the society's medal and £25; No. 26, 'The chemical composition of the products from the so-called kerosene shale of New South Wales,' the society's

medal and £25. Series viii. (to be sent in not later than May 1, 1889): No. 27, 'On the chemistry of the Australian gums and resins,' the society's medal and £25; No. 28, 'On the aborigines of Australia,' the society's medal and £25; No. 29, 'On the iron-ore deposits of New South Wales,' the society's medal and £25; No. 30, 'List of the marine fauna of Port Jackson, with descriptive notes as to habits, distribution, etc.,' the society's medal and £25. The competition is in no way confined to members of the society, nor to residents in Australia, but is open to all without restriction. No award will be made for a mere compilation, however meritorious in its way: the communication, to be successful, must be either wholly or in part the result of original observation or research on the part of the contributor.

— The annual report of the director of the Harvard observatory, which was presented to the visiting committtee on Dec. 7, has just been printed as a part of the report of the president of the university. Professor Pickering is to be congratulated upon the highly satisfactory financial basis on which the observatory is at length placed, through the munificence of the late Robert Treat Paine. About half of the Paine bequest, or $164,-198, is now available; and the endowment of the observatory, which was $164,000 in 1875, and $227,000 in 1885, has now risen to $398,046. A share of the increased funds must be applied, for the present, to needed repairs, and to the publication of observations already made. The 15-inch equatorial is to have a new mounting, and Professor Pickering hopes that at no distant day means may be found for replacing the observatory building by one better adapted to the requirements of modern astronomy. The report details the work of the various instruments, particular attention being given to the subject of photometry, as in past years. The most important new work of the observatory is in the field of stellar photography. For this investigation Mrs. Draper has lent the 11-inch photographic lens employed by her husband, the late Dr. Henry Draper, at his observatory on the Hudson, and has provided means for its new mounting, as well as for the prosecution of the researches to which it is to be devoted. We regret to note the resignation of Professor Rogers, the first assistant for the past fifteen years, and the observatory suffers a second loss in the resignation from its staff off Mr. S. C. Chandler, jun.

— During the past week the U. S. fish commission made the following distribution of California trout in the localities given: 300 yearling trout were placed in Swinks Lake, near Scottsboro, Ala.; 175 yearling in Sauters Creek, Ala.; 175 two-year-old in Paint Creek, Ala.; 175 yearling in Bear Creek, near Benton, Ala.; 75 yearling and 100 two-year-old in Flint River, near Brownsboro, Ala.; 175 one-year-old in Crow Creek, Ala.; 175 two-year-old in Lookout Creek, near Rising Fawn, Ga.; 178 two-year-old in the South Fork of the Chickamauga River, near Chattanooga, Tenn. The next distribution of trout will be made during the coming week, and will cover the states of Ohio, Indiana, and Michigan.

— It has been settled that the gift of President White's valuable historical library to Cornell university is to be followed by the erection of a large library building by the college authorities.

## LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Sources of nitrogen assimilated by growing plants.

In my address before section C at Buffalo last August, I gave a *résumé* of the investigations made up to that time in respect of the sources of nitrogen consumed by plants. The general conclusions of this paper were given in the abstract of the address, which appeared in *Science*. Since that time two important investigations have been published, and I feel that I ought to add an abstract of these as a supplement to the one you made.

Atwater (*Amer. chem. journ.*, viii. Nos. 5 and 6) has shown, in two papers recently published, that in many cases there is a loss of nitrogen in germinating plants: in other words, nitrogen that may be present in a nitrified form, or in a form easily nitrified, may escape assimilation by being set free by the denitrifying ferment described by Gayon and Dupetit and Springer. The importance of this fact seems to have been overlooked by most investigators, and the intimate relation it has to all studies of nitrogen-assimilation will not be denied by any one. Generally it has been assumed, that, if plants show an amount of assimilated nitrogen equal to that in the seed and food supplied, it is a proof that no free nitrogen has been consumed, either directly or indirectly. But if it should be established that much assimilable nitrogen in the seed or food may be lost, then the above assumption cannot be true. As a contribution to the study of this interesting problem, Atwater's papers are worthy of careful consideration.

Hellriegel (*Zeit. d. Ver. f. d. Rübenzucker-Industrie*, November, 1886) has lately published a paper in which he shows that an active nitrifying ferment may prepare unassimilable nitrogen for plant-food. While the Gramineae appear to possess little capability of being nourished by the nitrogen that can be derived from the atmosphere, the Papillionaceae possess this power to a remarkable extent. To a sterilized earth free of nitrogen was added a few cubic centimetres of an aqueous extract of earth taken from a field where peas were in active growth. Peas were sprouted in pots of nitrogen-free and sterilized earth, and continued to grow until the nitrogen-supply of the seed was exhausted. They all then passed into a state of starvation. To some

of these pots the earth-extract mentioned above was added. In a few days the plants took on a new growth, totally out of proportion to what could have been caused by the minute quantity of combined nitrogen contained in the extract. The plants in the pots not receiving this remained in a dying condition. The micro-organisms in the case just mentioned inhabit a small bulb which appears on the roots of the plant, and in this laboratory the transformation of the nitrogen appears to take place.

These later investigations lend emphasis to the statement I made in my Buffalo address: "These views of chemists so distinguished, based as they are on a series of experiments, extended and laborious, even if not above criticism, must command our most serious attention. They expressly admit the possibility of the use of the free nitrogen of the atmosphere, but are careful not to literally affirm it."

H. W. WILEY.

Washington, Jan. 28.

## Halos seen at Denver.

On the afternoon of Friday, Jan. 7, and in the evening, there was a brilliant display of halos, etc., at Denver. I have been told that it began at about 1 P.M., but I did not see it until 2.30 P.M. At that time the sky was of a milky hue, from the presence of the ice-clouds. The parhelic circle, passing through the sun, parallel to the horizon, could be traced entirely around the sky, except in the immediate vicinity of the sun: parts of it were at times temporarily obscured by small, swiftly passing clouds. The two principal parhelia, 22° distant from the sun, were very bright, and secondary parhelia were seen at a distance of 120°. The halo of 22° radius, encircling the sun, was incomplete. In the zenith was a faint circle of red light about 20° in diameter. The quadrant nearest the sun was expanded into a magnificent lune 2° wide at the broadest place: it displayed the prismatic colors from red to violet, the red border being toward the sun. As the sun descended toward the west, the lune grew narrower and longer, being only 1° broad at 3.30 P.M. During the next ten minutes, clouds rising from the western horizon obscured the sun, and with it the parhelic circle. The lune was visible for a short time after the sun had disappeared, but at 3.40 P.M. it too had vanished. By looking toward the west during the display, the ice-crystals near the earth's surface were plainly visible, and had the form of slender needles.

In the evening the sky seemed clear, and the moon, lacking two days of being full, shone brightly. The paraselenic circle was complete, and beautifully contrasted with the dark sky. It was $1\frac{1}{2}$° broad opposite the moon, and grew narrower as it approached that luminary. It could be traced almost up to the moon's disk. At 8 P.M. the halo of 22° radius about the moon was very distinct: at the highest and lowest points there were rudimentary tangent arcs, and a consequent increase of brilliancy at those points. The paraselenae were not at the intersection of the halo with the paraselenic circle, but on the latter about 3° or 4° outside of the halo. The inner edge of the halo was a red circle, but the outer edge was an ill-defined ellipse, the major axis of which stretched between the two paraselenae, while its minor axis coincided with the vertical diameter of the red circle. The space between the inner and outer edges was filled with milky light. At 8.30 P.M. the paraselenae had disappeared. Secondary paraselenae were seen at distances of 120° from the moon. At 9 P.M. a bright arc having a uniform breadth of 3°, and exhibiting prismatic colors, was seen in the southeast, being a portion of a circle of about 40° radius, in the centre of which lay the moon. It passed through the triangle of conspicuous stars ($\delta$, $\epsilon$, $\eta$) in Canis Major. At 9.30 P.M. all the circles except this one had vanished, and at 10.30 it too had gone. I have been told that after midnight the entire system of circles re-appeared. There was no lune in the zenith before midnight, or after, as far as I have been able to learn. It was possible to see the ice-crystals floating down by looking toward the moon. I regret that I had no instruments for making accurate measurements of the angular distances which I estimated.

H. A. HOWE.

Denver university, Jan. 28.

## Consumption among Indians.

In *Science* for Jan. 21 (p. 76) reference is made to a supposition that "it is change of diet which is the most potent remote cause of consumption among the Indians." Another cause, in my opinion, is change of dress. Before he came under the influence of civilization, the Indian was not clothed in garments that would interfere with the free action of the pores of the skin. If a live rabbit be dipped in a solution of glue, so as to cover its body with a coating impervious to air, it is surprising how quickly the frequency of the respiratory movements increases, showing that the work of the lungs is increased by depriving the skin of free access to the air.

The process of civilization has a somewhat similar effect upon the Indian, though to a less degree. One of the first lessons in the effort to civilize him teaches him to envelop himself in clothing of a kind that tends to impede and impair the normal action of the skin, the pores of which are organs of excretion, — a mechanism by which morbid and waste material may be thrown out of the system. Deprived of the assistance afforded under previous conditions by the skin, the work of the lungs is greatly increased, rendering them peculiarly susceptible to bronchitis and pneumonia, — ailments which are commonly the forerunners of consumption. If we accept the theory of Koch, they make the lungs a suitable habitation for the bacillus tuberculosis.

If we study the pre-tubercular history of man, we find his clothing in those times far different from what it is to-day, when the percentage of death from consumption reaches so high a figure.

The fact that the mortality from consumption among the Indians immediately after they come under the influence of our civilization is so much greater than among the whites proves the truth of what I have advanced. We have had our liability to consumption from overworked lungs tempered by hundreds of generations of ancestors habituated to the use of clothing, so that our risk is much less.

The facts underlying these views are, 1°, the lungs are not the only organs of respiration; 2°, they are important excretory organs, and, like the kidneys or liver, they may be overworked; 3°, the skin, in its natural condition, as an organ of respiration and excretion, is a most important adjunct of the lungs.

HAL. C. WYMAN.

Detroit, Mich., Jan. 22.

## A plea for civilian control of the U. S. weather-bureau.

A recent discussion of the value of the signal-service weather-predictions was begun in the *Boston Transcript* by a letter from a Boston lawyer. A portion of the letter is here given: —

"*To the editor of the Transcript.* It would seem that it is time to call for a termination of the farce of publishing the official weather-prognostications, at least so far as the neighborhood of Boston is concerned. Whoever is in the habit of looking in the morning paper to find what weather is promised for the day must have been much impressed of late with the faculty for getting it all wrong, which the Washington bureau appears to possess. [Here follows a whole list of notable failures within a month.] In conclusion, I will only ask whether a 'weather-bureau' which produces such failures as these is worth the cost of its maintenance? It may claim, indeed, that it has sometimes prophesied right, but a man in a dark closet could not possibly have guessed always wrong."

A number of letters followed this from different persons, all of which agreed in regard to the inefficiency of the signal-service predictions; and this, I think, voices the general sentiment of the New England people. I had so frequently heard people last year, when they were speaking of the signal-service predictions, say, 'Anybody could guess at the weather,' that the question presented itself, Why was it, that, in face of the fact that the official bulletins claimed eighty or even ninety per cent of successful verification, the average New Englander had arrived at the conclusion that the signal service merely guessed at the weather? It occurred to me that the popular measure of success was not what per cent some arbitrary method of verification gave, but rather how much better were the predictions than those which could be made by people ordinarily without instruments of any kind?

In order to test this, I had Frank Brown, an intelligent steward of Blue Hill observatory, make weather-predictions at sunset for the following twenty-four hours on each day from last March to July inclusive. These predictions I recorded when made, and carefully verified them in accordance with the rules given by the signal service to voluntary observers for verifying the signal-service predictions. I then compared his predictions with those of the signal service, verified in the same manner, and I found that each month he obtained from three to ten per cent higher success than the signal service.

In order not to confine the test to one person alone, I asked Mr. and Mrs. Davenport, intelligent persons living near Blue Hill, but who claimed to know nothing about the science of meteorology, to make weather-predictions during the month of June. These predictions were made at sunset for the twenty-four hours beginning at midnight, and were based on the appearance of the sky alone without any instruments. These predictions were received and recorded when made, and the end of the month showed that the predictions of each, though slightly different, were eighty per cent verified, while the signal-service predictions during the same time were only seventy-seven per cent verified.

These results clearly show why many people do not regard the signal-service predictions as of value.

It would occupy too much space to attempt to show why the signal-service method of verification makes them appear to gain such high success: suffice it to say that many of the cases which, according to the rules adopted, must be recorded as successful, are most glaring failures.

During the last few months I have endeavored to ascertain the causes of the many failures in New England of the signal-service 'indications;' and I find in the position of New England between the lakes on one side, and the ocean on the other, I think, a fruitful cause of the failures of the signal service. We find from local observations here in Boston, that, when a storm approaching from the west passes over, the sky begins to clear almost immediately after the passage of the line of minimum pressure. But on a synoptic chart it is frequently found, that even though the centre of least pressure is off on the ocean, it is raining or snowing at certain lake stations, such as Marquette, Oswego, etc.; and the explanation is apparent, for the circulation of the wind is such as to drive the air across the great lakes to these stations, where it arrives laden with moisture and ready for precipitation. The signal service, ignoring all local influences, and basing their predictions on the eastward movement of weather-changes, predict over and over again rain or snow for New England, which, under such conditions, seldom arrives.

Again: an area of high pressure, approaching New England from over the Lakes, may be attended by fair weather; but immediately it arrives over the Gulf Stream, and begins to force air on the land from the north-east or east, rain begins; and numerous failures of the signal service can, I think, be traced to this cause.

I have not confined my studies of the signal-service predictions to New England, but have closely watched them over other parts of the country; and I have become convinced that the predictions are based almost entirely on the eastward movements of weather-changes, with but little regard to local influence, or to the facts elicited by the splendid researches during the last ten years of Loomis, Van Bebber, and a host of others. In other words, the science of weather-predicting in the United States has not advanced a step since the days of Joseph Henry and Espy. This, I believe, has largely if not entirely resulted from the military control of the weather-bureau. Conventional routine, and action without questioning, is a necessary part of military training, and it has produced its fruits in a blind following of a few rules and a consequent want of advance in military weather-predictions. Not only does the military organization fail to give the best results which might at present be obtained, but I believe it is immensely detrimental to the advance of meteorology to a higher and more scientific position. In Europe the men in charge of the weather-services are scientific men, who not only do their present work well, but, sustained and enthused by their work, are investigating the difficult problems which present themselves, and thus pushing meteorology to a higher and more scientific stand-point.

Nor do I think the detriment of the military organization ends with the predicting department. I have known personally a number of bright young men, intensely interested, and trained in science and scientific methods, who were kept out of the signal service on account of the military organization.

These men were aware of their ability to earn an ample sustenance in the world, and did not care to release their liberty and undergo whatever indignities might be cast upon them in a military organization. Twice recently intelligent sergeants of the signal corps have said to me that "for the salaries paid to our observers we could obtain some of the most intelligent men in our city; whereas we now have to put up with much less effective work." One of these told me of an assistant in his office who, on a very clear night, recorded the Milky Way as thin clouds moving slowly from the west. Of course, such men in the signal office as fear that they would lose their position by the transfer of the bureau to civilian control are bitterly opposed to the change, and several have given me this very reason for opposing the transfer.

That this communication may, in the present crisis, do something toward influencing the change to civilian control, which I believe so much needed, is my earnest hope. H. Helm Clayton.

Blue Hill meteor. observ., Jan. 30.

### The pineal eye in Tritylodon.

The accompanying cut represents the top of the skull of the remarkable mammal Tritylodon Owen. It is reduced to two-thirds natural size, the genus being much larger than any other hitherto known from the mesozoic period. In the interval between the parietals and frontals, *pa* and *fr*, is seen the parietal foramen, *pf*, which has exactly the same position and relations as in the lizard genus Sphenodon. In my communication to *Science*, Jan.


28, I spoke of this foramen which lodged the pineal eye "as greatly exceeding that of any of the recent lizards in relative diameter." I find, upon examining the Sphenodon skull, that this is a slight exaggeration, and for the words 'relative diameter' should be substituted 'actual diameter.' Even with this limitation, the fact is of remarkable interest, and adds to the rapidly accumulating evidence for the reptilian ancestry of the mammals.

Henry F. Osborn.

Princeton, Feb. 1.

### Simple qualitative test for artificial butter.

Professor Scheffer (*Pharm. Rundsch.*, 1886, iv. 248) has proposed the following test for distinguishing between genuine and artificial butter: a mixture is made containing 40 volumes of rectified amyl-alcohol and 60 volumes ether of .725 specific gravity at 15°. One gram of butter-fat is dissolved in 3cc. of this mixture at 26–28°. On the other hand, 1 gram lard requires 16cc. of the solvent, 1 gram tallow 50cc., and 1 gram stearin 550cc. For the experiment take a test-tube of 12cc. capacity, and place in it 1 gram fat, add 3cc. of the fusel oil-ether mixture. After tightly corking the tube, put it in a water bath of 18°, and with frequent shaking bring the temperature to 28°. If the butter is pure, the solution becomes perfectly clear at this temperature. If not clear, more of the solution can be run in out of a burette, and the additional quantity required will be some indication of the quantity or quality of the adulterant which has been used.

According to Scheffer, mixtures of pure butter and lard gave the following data: —

| Butter. | Lard. | Quantity of mixture required. |
|---|---|---|
| 1 gram | — | 3.0cc. |
| .9 " | .1 gram | 3.9 " |
| .8 " | .2 " | 4.8 " |
| .7 " | .3 " | 5.7 " |
| .6 " | .4 " | 6.5 " |
| .1 " | .9 " | 14.4 " |

A trial of this method has shown that it is capable of giving valuable qualitative indications as to the purity of the sample under examination. I believe it is the best simple test, capable of general application, which has been proposed. I have adopted a simpler method of getting sensibly constant weights than the one recommended above. The butters or substitutes to be examined are melted and filtered in the usual way to remove salt, water, etc. A 1cc. pipette is used to measure out the fat, which will be sensibly .9 of a gram. All the graduated apparatus necessary for this test is, therefore, a 1cc. and 3cc. pipette.

The theory of the test is, that tri-stearin is less soluble in the amyl-ether mixture than the other butter-fats, and that the fats used as butter-substitutes contain more of this substance than pure butter. The test is chiefly valuable for its simplicity and wide application. H. W. Wiley.

Washington, Jan. 28.

### German constructions.

I should like to ask your correspondent, Mr. Eggert, if he supposes there exists any other language admitting of so horrible a construction as the placing-together of *six* pronouns in immediate contact?

"O du der du mich den ich so zärtlich liebe!"

It is true that German writers of to-day show a material gain in clearness over most of those who wrote a hundred years ago, and this is doubtless owing to the increased familiarity of educated Germans with the shorter sentences and less parenthetic forms of construction used in English and French.

M. Carey Lea.

Philadelphia, Jan. 27.

## Calendar of Societies.

*Philosophical society, Washington.*

*Jan.* 29. — F. W. Clarke, Present status of mineralogy; R. T. Hill, The topography and geology of the cross-timbers of Texas.

*Feb.* 12. — H. A. Hazen, The sky-glows of 1883; Bailey Willis, Bay's Mountains, Tennessee; George E. Curtis, Cowls and suction anemometers.

*Boston society of natural history.*

*Feb.* 2. — J. S. Kingsley, Development of arthropods and their relationship to worms.

*Scientific society, Purdue university.*

*Jan.* 19. — W. A. Fankbauer, The January cold-wave; J. Troop, The food of the English sparrow; A. H. Stahl and C. R. Barus, Summaries of recent work in mechanical engineering and botany.

### Publications received at Editor's Office, Jan. 24-29.

CANFIELD, C. W., *ed.* The American annual of photography and photographic times. New York, Scovill manuf. co. 295 p. 8°.

EDWARDS, J. Differential calculus. New York, Macmillan. 439 p. 16°. $2.75.

KENNEDY, A. B. W. The mechanics of machinery. New York, Macmillan. 652 p. 16°. $3.50.

LAURIE, S. S. The rise and early constitution of universities, with a survey of mediaeval education. New York. Appleton. 293 p. 12°.

RUSSELL, I. C. Geological history of Lake Lahontan. (U. S. geol. surv., monogr. xi.) Washington, Government. 288 p. 4°.

## Advertised Books of Reference.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 4, 1887.

## *SOME MISCALLED CASES OF THOUGHT-TRANSFERRENCE.*

SUCH is the title of an article in *The national review* (January, 1887), by Ada Heather-Bigg and Marian L. Hatchard. This article deserves to be read by every one interested in the subject, and especially by the members of the English society for psychic research. This society takes the position, that, having ruled out fraud and collusion, and still finding a larger ratio of successes than chance would allow, the only thing left is telepathy; and this is forthwith raised to the dignity of a new and omnipotent power explaining all the mysterious occurrences in hypnotism, in 'phantasms of the living,' in deathbed and other presentiments, and the like. The true logical conclusion is, that, such a thing as telepathy being so utterly opposed to the accumulated scientific knowledge of centuries, the probability of finding other sufficient modes of explaining the phenomena in question is extremely great: in other words, the inference is, not that telepathy is a fact, but that the modes of explanation thus far considered do not form a set of exhaustive alternatives.

This is the rational position taken by the writers of this article; and one might say of this, as they do of a similar point, that "it is a striking proof of the blinding effect of preconceived opinion on even careful investigators, that such cautious and candid inquirers as Messrs. Barrett, Gurney, and Myers should have failed to perceive this."

The notion of thought-transferrence was doubtless suggested by the commonplace and yet very impressive incident of two persons simultaneously expressing the same thought.[1] But knowing, as we do, how closely alike are our modern education and interests, the wonder is, rather, that these coincidences are not more frequent and startling. This process is termed 'similar brain-functioning' in the above article; and the reason why its importance is apt to be overlooked is because "so much of our mental activity goes on sub-consciously. Thus the resembling *results* are forced upon our notice, while the resembling *processes* get overlooked."

[1] Children are very much impressed by such coincidences, and the writer remembers distinctly how in such cases the two children concerned would observe the strictest silence, and, locking their little fingers together, would make a wish which was believed sure to come true.

G. H. Lewes tells a story in point. Walking in the country with a friend, he heard the sound of horses' hoofs behind them, and, when the riders passed by, at once remarked that he was convinced that the riders were two women and a man, which they really were. His companion declared he had formed the same conjecture (evidently thought-transferrence, says the Psychic research society). Mr. Lewes puzzled over the matter, but could not think of a characteristic distinguishing the sound of a horsewoman from that of a horseman. As, however, it is a fact that men trot and women canter, the two different sounds had unconsciously registered themselves in the brains of himself and his friend.

This shows that (as must occur daily) "two persons may tend to function similarly in response to certain stimuli, yet neither of them be aware of the tendency;" and it is just such phenomena that get utilized by the telepathists.

Guessing a number is a very popular mode of studying thought-transferrence; and, when the correct guesses are more frequent than the action of chance would predict, the hypothesis of telepathy is thought to be favored. "From this conclusion we emphatically dissent, on the ground that an appreciable percentage of the successes must be put down to the credit of similar but independent brain-functioning. For it is a fact, admitting of easy verification, that the ordinary human mind (provided, always, that it be subjected to no other biassing influence beyond that involved in the verbal framing of the necessary questions) tends to select particular numbers in preference to others:" in other words, these writers have independently discovered the 'number-habit' which Dr. C. S. Minot has so ably discussed in the Proceedings of the American society for psychic research. This discovery was brought about by noticing that quite constantly an undue number of successes occurred at the *beginning* of many sets of number-guessings. The explanation is, that at first the sceptic regards the whole process as nonsensical, thinks of the first number that pops into his head, that is, he follows his number-habit; but later, wondering at the successes, he suspects something, and adopts a more arbitrary mode of selection; whereupon the successes are less frequent.

They verified this supposition by simple experiments; and, to avoid the telepathist's objection that perhaps the tendency to choose particular

numbers was 'transferred,' twenty or thirty friends were asked to put prescribed questions and tabulate the results. The results obtained were entirely confirmatory of the so-called number-habit, and "it is clear that this varying predilection for different numbers materially vitiates all reasoning based on the assumption that we shall indifferently choose *any* number." Not only are particular numbers favored, but there are decided tendencies to select numbers on certain principles: here, again, the results first reached by Dr. Minot are corroborated. For example: in 1,120 trials in which multiples of ten would have been selected 109 times by the action of chance, they were actually selected 307 times. When persons were asked to choose a number (no limits being set), it was found, that, in 172 trials, 84 chose numbers under 20; and 59 of these, numbers under 10. Yet, if you set 1,000 as the limit unconsciously implied by each person, numbers under 20 would occur only 3.26, and under 10 only 1.54 times. Again: when limits were set to the numbers to be thought of, there was a strong disposition to avoid early numbers, and select those near the farthest limits. The table recording the result of the numbers persons are most likely to choose is very suggestive, and should be compared with the tables given in Dr. Minot's report.

In short, as was recognized long ago by some psychologists and writers on probabilities, the human mind is not calculated to act like a die-box or a raffling-wheel, and to have numbers *chosen* is a different thing from having them *drawn*. In fact, it is possible to suggest a certain kind of number-preference by the framing of the question. When the question read, 'Choose a number containing *three* figures,' the digit 3 occurred more than twice as often as it should have done by the action of chance. Of course, this phenomenon is not confined to numbers: guessing letters of the alphabet, names of people and towns, and the like, would be very apt to be unusually successful by reason of independent similar brain-functioning. In choosing letters, three tendencies are observed: 1°, to choose A, B, and C (of 172 people, 37 chose A, 31 B, and 14 C); 2°, to choose one's own initial (this was done 27 times in 172 cases); 3°, to choose Z (12 times in 172 cases).

The arguments in favor of supersensory thought-transferrence would apply as well to the common simultaneous discovery of new points in science by widely separated observers, or even to the similarity in customs of unrelated savage tribes (which Mr. Tylor so interestingly describes and so rationally explains), as to the number-coincidences of the usual 'telepathic' experiments. The same causes that led to the development of the decimal system, or to the selection of certain numbers as sacred or ill-omened, are still active in creating the preference for certain numbers which is so easily overlooked. Experiments taking this factor into account can be devised, and, when the results still leave a residue of unexplained phenomena, it is time enough to begin to consider the remote possibility of real telepathy. J. J.

## *IS BOTANY A SUITABLE STUDY FOR YOUNG MEN?*[1]

AN idea seems to exist in the minds of some young men that botany is not a manly study; that it is merely one of the ornamental branches, suitable enough for young ladies and effeminate youths, but not adapted for able-bodied and vigorous-brained young men who wish to make the best use of their powers. I wish to show that this idea is wholly unfounded, but that, on the contrary, botany ought to be ranked as one of the most useful and most manly of studies, and an important, if not an indispensable, part of a well-rounded education. In support of this view, these four good and cogent reasons can be adduced: —

1. *The study of botany is an admirable mental discipline.* Any education is defective which includes no training in the scientific method of study; that is, in developing the powers of careful, minute observation and comparison in some department of nature. By this means is acquired the habit of investigation, or the seeking-out of nature's mysteries by the use of one's own senses, instead of trusting wholly to the observations of others. This method of study may be learned through any branch of science; but botany presents this advantage, that it can be pursued with less inconvenience and less expense than any other. The mental training which botany affords is very thorough. The details of plant-structure are infinite, and essential peculiarities are often so hidden as to be recognized only by the most minute investigation. This involves the use of the microscope, which every educated man ought to understand, since it reveals to the eye a newly discovered and wonderful world, — a world of which our grandfathers had but the faintest glimpses, but which is scarcely inferior in interest to that larger world which the unaided eye can see. After this training of the powers of perception and comparison, comes the process of generalization, whereby the laws of vegetable life are determined from the study of plant forms and modes of growth. Thus is acquired the habit of

[1] From the first number of *The Swiss Cross.*

inductive reasoning, or the supporting of every general proposition upon a solid foundation of positive, indisputable fact.

Learning the names of plants is but the beginning of the study of botany. It is like learning the names of our companions or schoolmates before we become really acquainted with them. After we have learned to tell plants apart and to call them by name, we have presented for study such problems as the laws governing their distribution, the relation between the florae of different continents, and the relation of variety to species, which introduces the subject of Darwinism. The study of botany also includes the fossil plants, and, by enabling us to trace the vegetable kingdom from its first appearance upon the earth through all the varying conditions of the geologic ages, opens those tremendous scientific questions as to the birth and infancy of this world of ours which we now see in its maturity, and as to what it will become in its old age. These researches afford not only the amplest mental training, but abundant occupation for the longest life.

2. *The study of botany promotes physical development.* The botanical student must be a walker; and his frequent tramps harden his muscles, and strengthen his frame. He must strike off across the fields, penetrate the woods to their secret depths, scramble through swamps, and climb the hills. The fact that he walks with an earnest purpose gives a zest to these rambles; and he comes home proud and happy from his successful search for botanical treasures, with a keen appetite and an invigorated body and mind. He has enjoyed himself more thoroughly, and gained more substantial benefit, than those who have devoted the same time to the bat, the racket, or the bicycle. In his vacations the young botanist can toughen himself by making long and delightful excursions, living all summer in the open air, and may even have opportunities for joining government exploring parties, and enjoying the active out-of-door life full of adventure and useful experience.

3. *The study of botany is of great practical utility.* It is an essential preparation for several important pursuits. The physician and pharmacist need to have a practical knowledge of those plants which are used as medicines; and, if this knowledge is not acquired in early life, the opportunity never afterward presents itself. For the protection of our rapidly dwindling forests, the services of many skilled foresters will soon be required; and the forester must be a practical botanist. So must also the horticulturist, whether professional or amateur. For the most accomplished botanists, who desire to make this their life-work, there will always be places as instructors in our many colleges.

4. *The study of botany is a source of lifelong happiness.* Whatever may be one's station or pursuit in life, it is a great thing to have an intellectual hobby, which will afford agreeable and elevating occupation in all leisure hours. Botany is one of the best of hobbies. It can be studied out of doors from early spring till the snow falls; and even in winter there is plenty to be done in the analysis of dried specimens and the care of the herbarium. The botanist lives in the fresh air and sunshine; and when he leaves the world behind, and seeks, amid the solitudes of Nature, to penetrate her wondrous mysteries, he feels the quickenings of a higher life. A taste for botany wonderfully enhances the pleasures of travel, and also gives happiness and content to him who stays at home. It is equally efficacious in preventing the *ennui* of wealth and the anxieties of poverty. If one's surroundings are uncongenial, and life proves full of cares and disappointments, it is a great solace to be able to say with Aurora Leigh,

> "I was not therefore sad,
> My soul was singing at a work apart."

For these reasons it is obvious that the study of botany is peculiarly rich in those elements which conduce to a vigorous mind and body and a robust character. It is therefore pre-eminently a manly study, and an invaluable part of a young man's education. The student may rest assured that the time and effort devoted to it are well spent; for the result will be to make him a wiser, stronger, more useful, and happier man.

J. F. A. ADAMS, M.D.

## THE TENDENCY OF CONTEMPORARY GERMAN THOUGHT.

ROBERT ZIMMERMANN, writing of contemporary German literature in the *Athenaeum*, expresses the following opinion as to the philosophic tendency in Germany: —

"Scientific men, particularly physiologists and anthropologists, whose problems involuntarily touch on the domain of philosophy, and in particular of psychology, are yielding to a spiritualistic impulse that attracts them beyond the limits of the material. The science of man, according to the opinion prevalent among naturalists, is a chapter in zoölogy. The 'Entwicklungsgeschichte des menschlichen Geistes,' by Gustav Hauffe, of which the first part previously published contains 'Anthropology,' traces back the essence of man's nature to an absolute and indissoluble union of the corporeal with the psychic element, the spiritual soul with the material body, — a method that re-

minds us of Hegel, who had incorporated anthropology as the first chapter of his theory of the subjective intellect, that is, according to his use of language, of psychology, an arrangement in which he was followed by his school. Dubois Reymond's thoughtful and well-expressed 'Akademische Reden' reveal the irresistible need of something beyond this material world in their acknowledgment of 'world riddles' and of psychic phenomena as accompaniments of physical processes. The physicist E. Mach's clear-sighted 'Beiträge zur Analyse der Empfindungen' keep within the limits of 'psychophysics,' without throwing any doubt on the existence of the psychical. However, the collected essays of W. Wundt, who was bred a physiologist, prove that even an investigator who starts from purely empirical causes feels the need not only of philosophy, but also of the special branches that have always been included under this head, psychology, logic, ethics; while even metaphysic, though fallen into contempt, is asserting itself again, however much the aim of this new inductive science may differ from the old speculative one that bore the name."

## *CONSANGUINITY AND MENTAL UNSOUNDNESS.*

THE question of the effects of consanguinity is one of those vexed problems on which much evidence has been collected *pro* and *con*. The observations have been made by careful observers; and the most probable explanation of the diversity of the results reached, is that other circumstances have in some cases cancelled the bad effects of too close interbreeding, and in other cases brought them into prominence. A very fair consideration of the problem is given by Dr. G. E. Shuttleworth, in the *Journal of mental science* for October, 1886.

The common misgiving as to the propriety of cousin-marriages is of rather recent origin. In ancient times marriages of near kin were not forbidden; the first prohibition of them is in the fourth century A.D. The Church soon came to cast its odium on marriages even of the seventh degree of relationship, and the fees for removal of such objections by dispensation were an important source of revenue. This has undoubtedly influenced popular opinion on the question.

From the physician's point of view, the evidence from the animal world is important. Here there is almost a consensus, that, while the effect of 'in-and-in breeding' is to intensify *points*, in the long-run it is opposed to vigor of constitution. It is to be remembered that every breeder takes care to exclude any animals with any known morbid tendency, while, on the contrary, in the genus Homo, as Dr. Clauston remarks, there seems to be "a special tendency for members of *neurotic* families to intermarry." The result of this will be that in some portions of the population the offspring of such marriages will show the evil results of it to an unusual extent. And thus we find, that in rural and especially in mountainous districts, where the population is small and fixed, the comparative amount of idiocy is greater than elsewhere. Statistical information is inadequate on the subject: the motion to include it in the census returns of England was rejected "amidst the scornful laughter of the house, on the ground that the idle curiosity of speculative philosophers was not to be gratified." In France the returns have given rise to various estimates (varying from $\frac{9}{10}$ to $2\frac{1}{4}$ or 3 per cent) of the frequency of consanguineous marriages. Mr. G. H. Darwin came to the conclusion that in London $1\frac{1}{2}$ per cent of all marriages were between first-cousins, in urban districts 2 per cent, and in rural districts $2\frac{1}{4}$ per cent.

If, now, we ascertain the ratio of idiots and insane patients that are the offspring of such marriages to the total number of patients in the asylums, we will have some means of estimating the results of consanguinity. From quite an extended series of records, it is concluded that the ratio just referred to in the idiot-asylums is from 3 to 5 per cent: hence "*first-cousin* marriages, at any rate, are to some extent favorable to the production of idiot children." But this conclusion must be tempered by the consideration that in a large number of such cases of idiocy and imbecility other causes for this condition are present; and this consideration leads Dr. A. Mitchell to the opinion that "under favorable conditions of life the apparent ill effects of consanguineous marriages were frequently almost *nil*, while, if the children were ill fed, badly housed and clothed, the evil might become very marked." From such facts and figures we may conclude that first-cousin marriages should, as a rule, be discouraged; but that, if a close scrutiny reveals no heritable weakness, neurotic or otherwise, the banns need not invariably be forbidden.

## *ALLGEMEINE NATURKUNDE.*

IN the production of elaborate works on natural science for the general scientific reader or student, the Germans are *facile princeps*. Besides bearing evidences of thoroughness and general accuracy, such works usually present a homogeneity and

*Allgemeine naturkunde.* Leipzig, Bibliographisches institut. 8°. (New York, Westermann.)

completeness rarely attained in English ones of a similar class. To vivacity of expression and the more purely literary embellishments or literary condiments, they rarely make pretensions; and yet he who has read in the original the writings of such authors as Haeckel will readily concede that the German style may be not a whit less charming, less simple, and less interesting than the French or English, while at the same time combining, what is often such a fatal defect in many French works on general natural science, a rigid regard for scientific truthfulness. Buffon made many book naturalists, but he has much to answer for in the self-sufficient complacency and inexactness of many of the French naturalists who have succeeded him. It is a rare talent that can excel in attractive literary exposition, and yet command the respect of the critical scientific naturalist.

At least measurably successful as furnishing interesting and instructive reading for the non-scientific intelligent reader, and as an exhaustive storehouse of information for the general student, is the *Allgemeine naturkunde*, a work, of its kind, which, for fulness of treatment, richness and wealth of illustration, and, withal, general readableness, has rarely if ever had its equal. The work will be completed in nine large octavo volumes, of which four are now issued, and will contain over three thousand engravings on wood, — for the greater part original, — one hundred and twenty colored plates, and twenty maps. The series really is composed of four separate works, which might find their places on the bookshelves of the geologist, botanist, anthropologist, and anatomist, dealing with man, individually and in general, plant-life, and geology in its widest sense. It is intended as a continuation of Brehm's 'Tierleben,' a work well known in itself, as well as from the numerous engravings borrowed from it in the recent English and American natural history works of a similar kind.

The published volume of the two papers on 'Erdgeschichte,' by Neumayr, deals with general physical, dynamical, and stratigraphic geology. 'Der Mensch,' by J. Ranke, treats of the embryology, development, anatomy, physiology, psychology, and zoölogical relations of man, and is followed by three volumes on 'Volkerkunde' by Ratzel. This latter part is especially full and interesting, and is richly illustrated by engravings, maps, and colored plates. Finally, the remaining two volumes, 'Pflanzenleben,' by Maxilaun, are to contain a general exposition of plant-life, structural, physiological, systematical, and economical, with forty colored plates.

The four volumes now published — 'Mensch,' 'Erdgeschichte,' and 'Volkerkunde' (two volumes) — fully bear out the promises of the publishers. The numerous engravings, colored plates, and the typography are excellent; the descriptive matter readable, and for the most part interesting, and scientific. The style varies, of course, with the different authors, that of Professor Ranke being less clear and terse than that of either Professor Ratzel or Professor Neumayr. From the perusal of what has already appeared, the writer has found generally but little discussion of hypotheses, and, wherever critically examined, full and latest results of modern research. Of the general reliability of the work, the authors' reputations will afford sufficient evidence.

## METHODS OF ARROW-RELEASE.

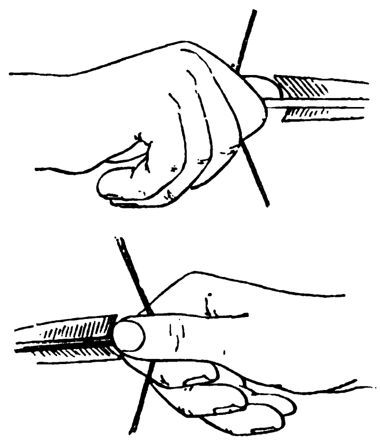
THIS substantial pamphlet, reprinted from the Bulletin of the Essex institute, October-December, 1885, is a noteworthy example of the thorough methods of modern archeological research. Professor Morse has laid under contribution not only narratives of travellers and explorers among the existing savage races, but all available records, graphic and other, of ancient times, to illustrate the manner of using the bow and arrow. This remarkable invention, as the late Lewis H. Morgan, in his well-known work on 'Ancient society,' has shown, did not make its appearance until mankind was well advanced in the savage state towards barbarism; and it has survived to the present time among primitive peoples as the principal weapon of warfare and the chase. It is reasonable, therefore, to hope with our author that interesting results in tracing the affinities of ancient races may be derived from the minute study of the different ways in which it has been employed.

Professor Morse's attention was first directed to the subject by observing that his method of shooting was quite different from that of a Japanese friend: "In the English practice, the bow must be grasped with the firmness of a smith's vice; in the Japanese, on the contrary, it is held as lightly as possible; in both cases, however, it is held vertically, but in the English method the arrow rests on the left of the bow, while in the Japanese it is placed on the right. In the English practice a guard of leather must be worn on the inner and lower portion of the arm to receive the impact of the string; in the Japanese no arm-guard is required. . . . In the English method the string is drawn with the tips of the first three fingers, the arrow being lightly held between the

*Ancient and modern methods of arrow-release.* By EDWARD S. MORSE. Salem, Bull. Essex inst. 8°.

first and second, the release being effected by simply straightening the fingers; in the Japanese the string is drawn back by the bent thumb, the forefinger aiding in holding the thumb down on the string."

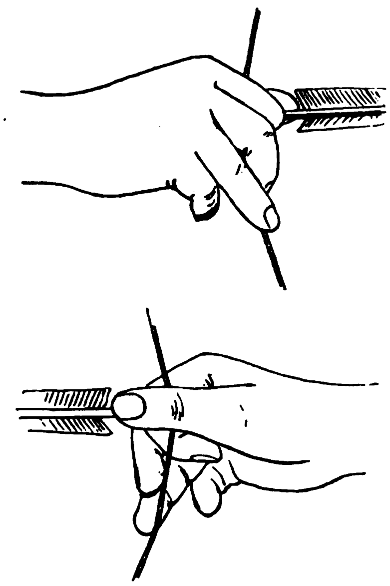
Thus set upon inquiry, he has discovered that there are, or have been, five different methods in vogue in the use of the bow and arrow. The simplest consists in "grasping the arrow between the end of the straightened thumb and the first and second joints of the bent forefinger. . . . With a light bow, such a release is the simplest and best; and it makes but little difference upon which side of the bow the arrow rests, provided the bow is held vertically. This release, however, prevents the drawing of a stiff bow, unless one possesses enormous strength in the fingers." He calls this the 'primary release.'



FIGS. 1 AND 2. — PRIMARY RELEASE.

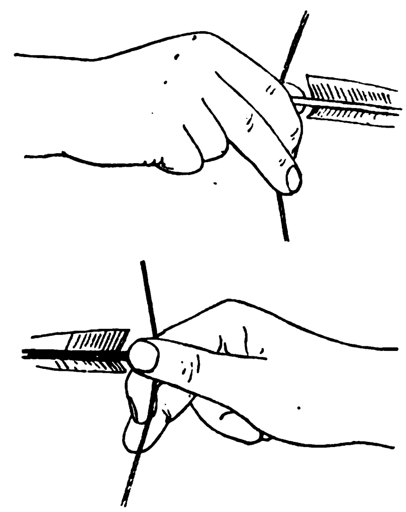
It appears to have been the method used by the natives of this country, when first discovered, according to William Wood's quaint description: "For their shooting they be most desperate marksmen for a point blancke object . . . they can smite the swift-running Hinde and the nimble-winged Pigeon without a standing pause or left-eyed blinking; they draw their Arrowes between the fore finger and the thumbe; their bowes be quick, but not very strong, not killing above six or seven score" (*New England's prospect*, part ii. chap. xiv., Prince soc. ed., p. 97). Several of the American tribes still practise this method of release, and our readers have doubtless seen Indian boys shooting in this manner. This is also the habit followed by the Ainos, the primitive inhabitants of Japan.

The second manner of release "consists in grasping the arrow with the straightened thumb and bent forefinger, while the ends of the second and third fingers are brought to bear on the string to assist in drawing." This is an advance upon the first through the help afforded by the other fin-



FIGS. 3 AND 4. — SECONDARY RELEASE.

gers in drawing the string. This is designated as the 'secondary release,' and is stated to be the method employed by the Zuñis, the semi-civilized Pueblo tribe, living in the north-western part of New Mexico.

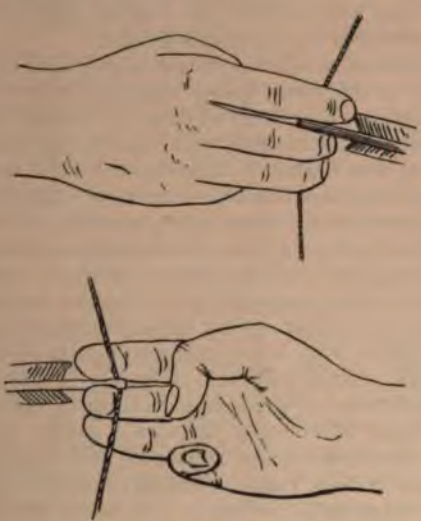


FIGS. 5 AND 6. — TERTIARY RELEASE.

The third method, which he styles the 'tertiary release,' "differs in the position of the forefinger,

which, instead of being bent and pressed against the arrow, is nearly straight, its tip, as well as the tip of the second and sometimes that of the third finger, engaging the string." This is the kind of release practised by most of the western tribes of this country.

"In holding the bow horizontally, the release-hand is held with the palm uppermost, the arrow, of course, resting on the bow, . . . but necessities arising, as in shooting in a forest, or shooting side by side with others closely appressed, the bow was required to be held vertically. In thus turning the bow-hand in the only



FIGS. 7 AND 8. — MEDITERRANEAN RELEASE.

way it could be turned conveniently, the arrow would be brought to the left of the bow vertical. . . . In the primary and secondary releases, however, it makes but little difference on which side the arrow is placed; and some tribes, using the bow vertical, place the arrow to the right, and this is probably a quicker way of adjusting the arrow when shooting rapidly."

Professor Morse next considers a form of release "which by documentary evidence has been in vogue among the Mediterranean nations for centuries. It is the oldest release of which we have any knowledge. It is practised to-day by all modern English, French, and American archers, and is the one practised by European archers of the middle ages. It consists in drawing the string back with the tips of the first, second, and third fingers, the balls of the fingers clinging to the string, with the terminal joints of the fingers slightly flexed. The arrow is lightly held between the first and second fingers, the thumb straight and inactive."

Since it has been practised by the Mediterranean nations from early historic times, he very appropriately calls it the 'Mediterranean release.'

"This is unquestionably an advance on the others thus far described, as it enables the drawing of a stiffer bow, and is exceedingly delicate and smooth at the instant of loosing the arrow." It is quite remarkable that this method of release is practised by the Eskimo; which circumstance tends to confirm Prof. Boyd Dawkins's theory that this people is the direct representative of the cave-dwellers of southern France. The Eskimo are the only people known to Professor Morse, who have designed a distinct form of arrow for this method of release.

Finally Professor Morse proceeds to examine an entirely independent release, having no relation to the others. "In this the string is drawn by the flexed thumb bent over the string, the end of the forefinger assisting in holding the thumb in this position. The arrow is held at the junction of the thumb and forefinger, the base of the finger pressing the arrow against the bow. For this reason the arrow is always placed to the right of the bow vertical. This release is characteristic of the Asiatic races, such as the Manchu, Chinese, Kore-

FIGS. 9 AND 10. — MONGOLIAN RELEASE.

an, Japanese, Turk, and doubtless other cognate peoples."

As it is practised almost exclusively by Mongolian nations, he calls it the 'Mongolian release.'

In this release the thumb has to be protected by

some kind of a guard, which is generally a thick ring. "The releases vary in their efficiency and strength. The two strongest and perhaps equally powerful ones are the Mediterranean and Mongolian; and it is interesting to note the fact that the two great divisions of the human family who can claim a history, and who have been dominant in the affairs of mankind, are the Mediterranean nations and the Mongolians. For three or four thousand years, at least, each stock has had its peculiar arrow-release, and this has persisted through all the mutations of time to the present day. Language, manners, customs, religions, have in the course of centuries widely separated these two great divisions into nations. Side by side they have lived; devasting wars and wars of conquest have marked their contact; and yet the apparently trivial and simple act of releasing the arrow from the bow has remained unchanged. At the present moment the European and Asiatic archer, shooting now only for sport, practise each the release which characterized their remote ancestors."

We wish it were in our power to follow our author through his detailed investigations of the peculiarities in the use of the bow he has discovered in his truly marvellous study of the ancient monuments; but that is impossible. In a classified list he has given, under the heads of 'recent' and 'ancient,' all the tribes and nations who have practised the five different kinds of release described, and he concludes by begging for further information: —

"Travellers and explorers ought also not only to observe the simple fact that such and such people use bows and arrows, but they should accurately record, 1°, the attitude of the shaft-hand; 2°, whether the bow is held vertically or horizontally; 3°, whether the arrow is to the right or to the left of the bow vertical; and, 4°, whether extra arrows are held in the bow-hand or shaft-hand. The method of bracing the bow is of importance also. . . . Particularly does he desire to learn the release as practised by the Veddahs of Ceylon, the Hill tribes of India, the tribes of Africa, South America, and especially the Fuegans. Indeed, any information regarding the methods of arrow-release in any part of the world will be acceptable."

In answer to his inquiry, we venture the suggestion whether it is not possible that the so-called 'pierced tablets,' which are described and figured by Professor Rau (*Archeological collection of the Smithsonian institution*, p. 33) and other writers, and which have given rise to so much discussion among American antiquaries, may not have been guards worn to protect the wrist against the recoil of the bow-string. H. W. H.

## THE BUTTERFLIES OF NORTH AMERICA.

One welcomes an old friend more cordially than a new; so that when Mr. Edwards, after some hesitation, starts a third series of his renowned and incomparable illustrations of our native butterflies, begun twenty years ago, we are ready to render the full meed of praise for his unwearied energy, the success of his breeding experiments, and the more than liberal, almost profuse illustration with which they are published. When we know, in addition, that he has parted with a considerable portion of his unique collection to obtain means wherewith to launch this new series, we can only hope he will find a public properly appreciative of such zeal and sacrifice.

This first number is a reminiscence of the past. Two of the three plates represent hitherto unfigured species of that wonderfully prolific boreal genus Argynnis, one from Assiniboia, and the other from Utah and Arizona, with brief merely descriptive text — which remind us especially of his first series, where nearly seventy figures of this genus were given. The remaining plate gives not only the butterfly with its variations, but also all the earlier stages of our Californian species of Megonostoma (or, as Mr. Edwards prefers to class it, Colias), with many enlarged figures of minor details, accompanied by a tolerably full account of the insect — which recalls the more definitely biological character of the second series. To obtain the earlier stages, eggs were sent from California to West Virginia, and the caterpillars raised on an Amorpha, previously sent, in Mr. Edwards's garden.

The text is not so full or interesting as the later parts of the last series; but to say that the same care as before has been taken with the illustrations, whether in faithfulness of delineation to the last detail, or in truthfulness of coloring with an absence of all gaudiness, is quite enough. Nothing has ever surpassed them; they are a perfect model for such work. The same artists have been connected with the work almost from the first; and though the chief artist, Mrs. Peart, can no longer undertake the lithography with her own hand, they receive her careful supervision.

We can only congratulate naturalists on Mr. Edwards's determination to continue publishing on the same scale as before, and beg to remind them, that, but for this liberality, we should hardly have advanced in knowledge of the life-histories of our butterflies beyond what we knew when Boisduval and LeConte published their little octavo — a half-century ago.

*The butterflies of North America.* By W. H. Edwards. Third series. Part i. Boston, Houghton, Mifflin & Co. 4°.

# SCIENCE.

FRIDAY, FEBRUARY 11, 1887.

## *COMMENT AND CRITICISM.*

THE AUTHORITIES of the Johns Hopkins university have always held, and rightly, that the true university must not only afford ample opportunities for original research in library and in laboratory, but that it must also afford opportunity for the publication of the results of such research. As a result of this policy, the publication of the *American journal of mathematics*, the *American chemical journal*, the *American journal of philology*, the *Studies from the biological laboratory*, and the *Studies in historical and political science*, has been successively and successfully undertaken. The announcement is now made that this formidable list is to be extended by the addition of an *American journal of psychology*, under the editorship of Prof. G. Stanley Hall. The journal is to be published quarterly, and the first number will appear at an early date. The scope of the journal is to be as wide as that of psychology itself, though we infer from the announcement, that the major portion of the space will be devoted to the results of investigation in psycho-physics, psychogenesis, and to the physiological side of mental science in general. It is purposed also to reproduce entire valuable articles from other journals, when they are not readily accessible in their original form. The journal will, it seems to us, find a field awaiting it; for the *Revue philosophique* and the *Philosophische monatshefte*, together with their continental contemporaries, are hardly read in this country at all; and their columns seldom, if ever, print an article by an American scholar. *Mind*, to be sure, has been very generous of late in its allotment of space to American authors, but it has a very limited circulation in this country. To appeal, first of all, to American readers and students of mental science, and to embody the latest results of American research, should be the particular aims of the new journal.

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IN CALIFORNIA, if anywhere, forestry should claim proper attention from the state; and, apparently on the principle of better late than never, the first biennial report of the State board of forestry is now issued. A region like middle and southern California, on the borderland between sufficient and insufficient rainfall, where irrigation is essential to agriculture, must care for its streams, and must therefore care for the forests where they rise. By this it is not intended to assert that forests exercise any control over the amount of rainfall, and it is a satisfaction to see that this popular fallacy receives no very direct support in the report under consideration: but as regulators of discharge by streams, the importance of the relation between forests and rainfall cannot be questioned; and in a state like California, where the forests are peculiarly limited to the higher, rough, non-arable lands, whence the streams flow down to the farms below, the preservation of a fair share of the trees is a prime necessity. In the southern part of the state the balance of conditions is so delicate, that the forests merely survive, but have no recuperative power. If destroyed, they do not spring up again, but leave the surface barren. It is in such districts that much damage has already been done, not only in defacing the hill country, but in increasing the irregularity of stream-flow. The rain runs off from a bare hillside in a violent flood, carrying soil and gravel with it, and leaving no store of moisture in the ground to supply springs in the dry season. The forestry board and the school of forestry, inaugurated at Los Angeles in the University of southern California, have therefore a large work before them, that must become of much value to the state.

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IN THE *Nineteenth century* for January, Mr. George J. Romanes replies to the critics of his paper, read some time ago before the Linnaean society, on 'Physiological selection, — an additional suggestion on the origin of species.' He says that the first mistake his critics made, was in treating his idea as a fully elaborated theory, instead of, as was intended by Mr. Romanes, a mere suggestion or working hypothesis. He quietly adds that the study of his critics' arguments only makes him think more highly of his suggestion. Mr. Romanes' hypothesis of physiological selection sets out with an attempt to prove, that, con-

sidered as a theory of the origin of species, the theory of natural selection is inadequate. The evidence going to make up this proof falls under three heads: first, the inutility to species of a larger proportional number of their specific characters; second, the general fact of sterility between allied species, which it is admitted cannot be explained by natural selection, and therefore has hitherto never been explained; and, third, the swamping influence, even upon useful variations, of free intercrossing with the parent form. Because of these facts, Mr. Romanes asserts that the theory of natural selection is not a theory of the origin of species at all, but a theory of the cumulative development of adaptations. Physiological selection or 'segregation of the fit,' on the other hand, Mr. Romanes brings forward as a theory of the origin of species. After briefly explaining what is meant by physiological selection, — which he does in a way too compact to be abridged, and too long to be quoted, — Mr. Romanes turns to his critics, and deals with the objections which they have advanced. Two of them — Messrs. A. R. Wallace and Seebohm — are referred to by name, and Mr. Romanes' criticism of them is very interesting reading. He ascribes the objections of both of these gentlemen to a misunderstanding of what physiological selection really means, and deals with the whole subject in so comprehensive and yet detailed a way, that we may be sure a reply will be provoked from such of the critics as deem themselves misrepresented or unfairly used in the present article.

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THE CURRENT WORK of the U. S fish commission at its various stations shows gratifying results in hatching young fish. At Washington, 5,000,000 white-fish eggs are now being hatched, the fry to be sent to Lake Erie. Small lots of *Salmonidae* are also being hatched there, principally for the purpose of illustrating the different methods of fish-culture. At Northville and Alpina, Mich., 125,000,000 white-fish eggs were collected during the fall, of which 25,000,000 have been distributed to the state commissioners, for hatching and planting, and about 100,000,000 have been reserved to be hatched at the Northville station, the fry to be placed in the ocean and the great lakes. The station at Wood's Holl has been actively engaged in collecting, hatching, and distributing the eggs of cod-fish, of which 26,000,000 have been hatched and planted in Vineyard Sound and other adjacent waters. It is probable the total production of the season will exceed 100,000,000 cod-fish when eggs are obtained from the Ipswich-Bay school. At Wytheville, Va., the collecting of California trout eggs is now in full progress, over 100,000 eggs having been obtained, of which fifty per cent will be distributed in lots of 5,000 and 10,000 to the different state commissions, the balance to be hatched and reared at the station, and distributed as yearling fish to the streams of the Appalachian region in Pennsylvania, Virginia, West Virginia, North Carolina, Georgia, and Tennessee.

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THE DEBATE in the senate on the appropriations for the support of the coast survey during the next fiscal year shows the appreciation by that body of the importance of making appropriations sufficient to carry on the service effectively. The house pared the items down in a parsimonious spirit, and with a false idea of economy, without consulting the coast survey officials, or the treasury department, or the needs of the service. The senate appropriations committee addressed a letter to the secretary of the treasury, inquiring if the estimates as submitted by the superintendent of the coast survey were satisfactory to that department. The secretary replied that the estimates as submitted were entirely satisfactory, and fully sustained the superintendent of the coast survey. He also submitted an interesting and instructive communication from Mr. Thorn, showing the reasons for each item of expenditure and the present condition of the service, which we have not room to print. The secretary closed his letter with the following observation: "From these communications it appears that the estimates made provision for the efficient and economical prosecution of the survey during the ensuing year; it also appears that the provision made by the house bill will not secure such results: consequently the arrangement there made is not satisfactory to this department."

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THE EXPLANATION given by the investigators of the Plymouth epidemic of the origin of that epidemic has by some been regarded as unsatisfactory, because it required the acceptance of the theory that typhoid-fever germs could retain vitality after being exposed to the intense cold which prevails in that latitude during the winter. Dr. J. S. Billings, U.S.A., has been experimenting on this point, and gives the results of his experi-

ments to the *Sanitary engineer*. On Jan. 10, 1887, five cubic centimetres of sterilized water in a test-tube were inoculated with typhoid bacillus, and exposed to the outer air during the following night at a temperature of 10° F. It was found solidly frozen during the morning. Jan. 11, this frozen mass was thawed, and from it there were inoculated one agar and three gelatine tubes. On Jan. 13 there was a decided typical development of the typhoid bacillus in the agar tube and in two of the gelatine tubes. He says that evidently the vitality of the typhoid bacillus is not destroyed by freezing.

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ONE OF THE METHODS by which infectious diseases may find an entrance into a country is exemplified in the history of the introduction of cholera into the Argentine Republic. On Nov. 1 of last year, the Italian ship Perseo arrived at Buenos Ayres from Genoa. During the voyage nearly a score of persons had died of cholera on the ship. The ambassador of the Argentine government in Italy was a passenger on the ship, and, in the anxiety of the ship's commander to permit him to land without detention, all sanitary rules seem to have been overlooked. The disease was not confined to Buenos Ayres, but was also conveyed by the same ship to Rosario, some two hundred miles farther, where there were at one time from twenty-five to fifty deaths daily. The disease still exists in both cities, but is very much less prevalent than formerly.

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## *THE CONDITIONAL LIBERATION OF PRISONERS.*

THE advances making in prison science, — or penology, as some are fond of calling it, — in this country are easily discerned. Not only do the annual meetings of the national prison congress attract wider attention and attract larger audiences, but there is a growing thoroughness and method in the current discussions on prison topics that stamps them as scientific. The reading public at large, moreover, take an interest in these subjects, for they appeal to them on many accounts, — ethical, economic, and philanthropic.

In the *International record of charities and correction* has appeared a paper by the editor of that journal, which was read by him before the recent meeting of the prison congress at Atlanta, and which not only typifies the scientific method of treating prison questions, but shows its application to a particularly interesting subject. Mr. Wines discusses, in the article in question, conditional liberation, or the paroling of prisoners. He points out both the close relation and the distinction between the so-called indeterminate sentence and the conditional discharge of a convicted criminal under parole, and says, that, while in Europe the tendency has been toward conditional liberation under sentences which are of fixed duration, in the United States we incline to an indefinite sentence. On both continents the first experiments in conditional liberation have been made with juvenile offenders. As early as 1824 the charter of the New York house of refuge contained the germ of the theory of an indefinite sentence, and sixteen years later a law was passed by the legislature of the same state foreshadowing the principle of conditional liberation; but both acts referred only to offenders in their minority.

From the early experience of France, Mr. Wines adduces some significant statistics. In 1832 provision was made that prisoners discharged from *la petite Roquette*, the Paris prison for juvenile offenders, might be intrusted to a special society, which was authorized to apprentice them and watch over their conduct. The effect of this step was to cause a decrease in a few years of the percentage of juvenile recidivists from seventy-five to seven per cent. It was then proposed by an eminent judge that the plan which had proved so successful with juveniles be made applicable to adult criminals, but it is only very recently that this was done.

With respect to adults, the English, in their 'ticket-of-leave' system, were the first to try conditional liberation. Until 1853 this ticket-of-leave provision only applied to convicts shipped to Australia, but in that year it was extended to include convicts incarcerated on English soil. In more recent years the value of the system of conditional liberation has been more widely appreciated. It was adopted by the grand duchy of Oldenburg and the kingdom of Saxony in 1862, and its success in Saxony was such that it was embodied in the criminal code of the German empire, which took effect in 1871. In 1868 it was adopted by a Swiss canton, and in the following year by Servia. Denmark put it in application in 1873, as did the Swiss canton Neuchâtel. Croatia, and cantons Vaud and Unterwalden, followed, as did the Netherlands in 1881, and France in 1885. In 1882 Japan adopted it, and it is a portion of the criminal codes under discussion in Austria, Italy, and Portugal. The first recognition of the principle of conditional liberation in the legislatures of the United States was in 1868, when the state of New York established the Elmira reformatory.

The objection that a parole is a pardon, and must be granted under the laws and conditions governing pardons, Mr. Wines notices at some length. He holds that a parole is not a pardon, for the reason that when a convict is pardoned his liability under the law ceases; but when he is paroled, and until his conditional release merges into one that is absolute, he is still in the custody of the law and under sentence. This being an important point, Mr. Wines discusses it in detail. He shows, that, if a parole is unconstitutional, so is the time allowance now made in almost every state in the union to the convict, for good behavior while in confinement; and adds that "the history of the discussion of the indeterminate sentence, both at home and abroad, shows that until this legal, quasi-constitutional objection to it is disposed of, no progress can be made in the way of securing a candid and careful consideration of its practical advantages."

Passing from the legal to the practical side of the question, Mr. Wines claims, that, not only the *a priori* argument, but the results of its practical workings, are entirely in favor of the system of conditional liberation. Applied in any prison, it affects both officers and convicts. The former have a new responsibility thrown upon them, that of "judging at what moment each convict committed to their care is fitted for the test of character outside of the prison enclosure;" while the latter, finding his hope and his desire of personal freedom called upon, becomes an efficient and willing co-operator in his own amendment. "The system wakens in the breast of every prisoner who is not sunk in intellectual or moral inbecility, the sense of individual responsibility, and stimulates it to the highest degree of activity which he is capable of sustaining." The system is also recommended to students of criminal jurisprudence, because of the benefits it will confer upon society at large. It lessens the suffering of the family and friends of the criminal, and it diminishes the expense required for his maintenance. It is at once a thorough and the only practicable means of testing the prisoner's reformation in prison.

Mr. Wines does not overlook nor pass by the practical difficulties which are urged against the adoption of the system he is advocating. He considers them in turn. The first of them is "the ignorance and apathy of the public with reference to every phase of the question of prison discipline." As this has stood in the way of many important reforms before now, and has always had to yield in the end, Mr. Wines declines to give it any serious attention. It will cure itself. To the objection that a prisoner is naturally a hypocrite, and that therefore no correct judgment can be formed as to his improved character, it is answered, "How does this apply to the system of conditional liberation any more than to the good-behavior laws now so common?" In the United States, concerted action on the part of the various states would be necessary, in order to operate the system effectually. No special watching of the paroled convict is desirable, and the writer quotes prison-director Sichart of Wurtemberg, to the effect that police surveillance is undesirable; for the paroled prisoner should not be subjected to unnecessary mortification. What he requires is protection against any hinderance which may exist to his honorable success; and in no event should surveillance of any description be continued longer than the circumstances of each case seem to require.

Mr. Wines then develops his ideas as to the classes of convicts to whom the privilege of conditional liberation should be granted, the stage of imprisonment at which a parole should be granted, and the authority to whom the discretionary power of granting the parole should be entrusted. Statistics are quoted showing, that, of 1,695 paroled prisoners in Bavaria, only 59 relapsed; of 782 in Wurtemberg, only 8 relapsed; and of 286 in Saxony, only 6 relapsed. The statistics on this point gathered from the experience of the New York state reformatory at Elmira, are already known to our readers.

## LONDON LETTER.

THE character of the Friday-evening lectures at the Royal institution (the scene of the labors of Davy and Faraday) is probably well known to most readers of *Science*. The after-Christmas series was opened by Sir William Thomson, who discoursed to a brilliant audience upon the probable origin, extent, and duration of the sun's heat. Adopting, apparently unreservedly, Helmholtz's theory of its origin being due to the shrinkage of its mass, owing to gravitation, he pointed out that gravity was $27\frac{1}{2}$ times as great at the sun (at present) as at the earth, and how different, therefore, solar physics were from terrestrial. The mystery of the relation between gravitation and the other properties of matter had hitherto proved insoluble. A body falling through only forty-five kilometres on to the sun's surface, would develop more energy than any known chemical combinations, and hence he relegated such combinations to the domain of the determining influences of merely incidental changes. Much time was devoted to calculations of solar energy from the point of view of the 'mechanical equivalent of heat.'

The amount of solar shrinkage was probably about 0.01 per cent of his diameter in 2,000 years. Fifteen million years ago the sun was probably four times its present diameter, and in another twenty million, its density will equal that of lead, and the activity of solar radiation will probably greatly diminish. At present it was about 75,000 horse-power per square metre. Looking back, although biology demanded more time, the study of dead matter would give twenty million years as a maximum past limit, and ten million years as a maximum future limit, of the heat received at present by the earth from the sun. The speaker created some amusement, towards the end of his discourse, by admitting that 'However, after all, we know nothing whatever about it!'

The Prince of Wales has just been elected an honorary member (probably the first British one) of the Linnaean society, which has hitherto been somewhat chary of bestowing its 'parchments sealed with wax.' This famous society was founded in 1788, and is the owner and custodian of the library, manuscripts, and herbarium of the illustrious Linnaeus, who died in 1778. These were originally bought from his family for about $5,500, by Dr. James Edward Smith, who founded, and was first president of, the Linnaean society, which has comprised in its roll all the most distinguished naturalists of the day, and may be considered to be a select club of scientists.

The 'Christian evidence society' aims at counteracting the atheistic spirit which is alleged to be spreading among the masses in London. Latterly, its purely theological meetings and lectures have been frequently supplemented by lectures on scientific subjects delivered by men of well-known scientific position. In the west end of London, during the present month, the presidents of the Royal and of the Linnaean societies (Dr. Stokes and Mr. Carruthers) will take part in such a course, the former taking for his subject, 'Is the demand for demonstrative evidence in religion reasonable?' Dr. J. H. Gladstone and Mr. W. Lant Carpenter also take part in this course.

On Jan. 17 a notice was issued by the post-office cancelling all previous notices as to delay in the telegraph service owing to the break-down occasioned by the storm of Dec. 26. For the week ending Jan. 15, the number of messages was 803,000, as against 736,000 for the corresponding week of last year, notwithstanding the fact that senders were warned as to probable delay. The department has been able to have this good record while the wires were down, mainly through the free use of the Wheatstone automatic fast-speed transmitter, which for a long time has been doing 700 words per minute (350 in each direction, the line being duplexed) over one wire between Newcastle and London, about 300 miles. Every effort was made to get messages through, no matter how circuitous the route. Some messages reached London from Paris *via* New York. In the angry controversy which has been raging on overhead *versus* underground lines, the following statements have been put forward on authority: The English post-office has 20,000 miles of underground lines, as against 22,000 in Germany. The cost of an underground wire is £350 per mile, and of every additional wire, £15, as against £35 and £10 respectively for overhead wires. Underground wires diminish the speed of signalling from 25 to 75 per cent over long distances. The cost of renewal and maintenance is about the same in both cases.

The present year is the jubilee of the queen's accession to the throne. There is considerable fear that the proposal for an 'Imperial institute,' as a commemoration thereof, will not be adequately supported, and, in scientific circles, much feeling exists at the scanty recognition of science in the constitution of the committee (nominated by the Prince of Wales) which framed the scheme, and, *a fortiori*, in the scheme itself.

An interesting history of the 'Science and art department' has just been issued, showing its growth during the last fifty years, and the encouragement given by the state in this way to instruction in science and art. Its headquarters are in South Kensington, which is in connection with about 1,500 scientific schools all over the United Kingdom. Twenty-five distinct branches of science are taught, and the annual grant for its maintenance approaches half a million pounds sterling. This is mainly distributed on the results of the May examinations, held at the end of the winter's teaching. In connection with this are the scholarships due to Sir Joseph Whitworth's contribution of £3,000 per year, given in 1868.

W.

London, Jan. 22.

## *HONOLULU LETTER.*

Mr. E. D. Preston of the U. S. geodetic survey has just arrived and begun work under temporary engagement with the Hawaiian government survey. His task is to establish a normal or standard latitude for this group. The latitude of several points has already been carefully determined, — two such in 1883 by Mr. Preston in connection with pendulum observations, and some others by the British observers of the transit of Venus. Since full geodetic results have been obtained by inter-island triangulation, serious discrepancies are found to exist between these and

the astronomical determinations of latitude, rising as high as forty-five seconds of latitude in the relative positions of stations on neighboring islands. The study of these discrepancies shows them to be due to local deflections of the vertical in consequence of the powerful attraction of our great mountain-masses. The error produced appears to be greater than in any other part of the world in proportion to the extent of the geodetic work. A discrepancy in longitude of sixty seconds is found to exist between Kailua and Honolulu, 150 miles distant. These longitudes were determined by the British transit expedition, transporting twelve chronometers three round trips between the stations. The mountains of these islands rise above the sea from 4,000 to 14,000 feet. But being surrounded by a depth of ocean of, say, 25,000 feet, the masses are really from 30,000 to 40,000 feet high, fully accounting for the extraordinary deflection of the vertical. Twelve stations have been selected whose positions are precisely determined, and which lie on opposite sides of their respective islands. Mr. Preston will occupy each one, so as to secure at least one hundred observations of pairs of stars. It is believed that a study and comparison of the discrepancies between the latitudes obtained will enable a standard latitude to be determined for the whole group, very closely approximating to the true latitude.

No precise determination of longitude can possibly be obtained until there is cable communication between Honolulu and the continent. It now seems probable that such communication will soon be established. Mr. Preston's work will then be available in corrections to determine a standard longitude as well as latitude for this group. When these corrections for the latitude and longitude are applied to the transit of Venus station at Honolulu, it seems not unlikely that better results may be obtained from the work done by the British transit expedition.

A panorama of the caldéra of Kilauea goes today to the United States for public exhibition. It is an accurate representation of the great enclosure, and of the interior active lakes, as seen at the period of culminating action shortly before the periodical collapse which took place last year. The work is by an eminent artist, Jules Tavernier, who is particularly successful in vivid representation of incandescent lava. The whole is lifelike and realistic. Although startling, it possesses a high scientific value, far beyond a mere popularizing of the subject.

Since the collapse, the lava has re-appeared in force, and is slowly rising in the lakes, already presenting brilliant exhibitions. After a period of the highest activity, the lakes suddenly sank out of sight, leaving deep pits, the bottoms of which were 700 feet lower than the previous level of liquid lava. The surveyor-general embraced the opportunity for a precise survey of Kilauea and its branch craters, which has been completed. It will probably be several years before any thing like the recent high level of lava is again attained. A remarkable phenomenon still proceeding has been the uplifting from the bottom of the pit, as if by colossal jack-screws, of a veritable mountain island of lava more than 500 feet in diameter and 150 feet high, around which the liquid lava flows. This permanent island has already risen some 300 feet within seven months. The best facilities are now given for access to the crater, involving five days' absence from Honolulu, at the cost of fifty dollars, covering all transportation, hotel fare, and guides, with two days at the crater. K.

Honolulu, Jan. 18.

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## *GEOGRAPHICAL NOTES.*

### *Asia.*

Dr. A. Bunge and Baron E. Toll have returned form their journey to the New Siberian Islands. They have made valuable collections and observations on the five islands of this group, which of late became so famous by the hazardous boat journey of the Jeannette crew. The results of this, the first scientific expedition to these islands, will be of great interest.

There are new reports on Potanin's expedition to southern Mongolia. His return was announced in the St. Petersburg letter of last issue. Potanin left the district of Koko-Nor on June 25, 1886, crossed the desert of Gobi on a previously unknown route from south to north, and discovered four parallel chains of mountains, which form the south-eastern continuation of the Altai system. The journal of the Imperial Russian geographical society contains a report on his last explorations in the district of Koko-Nor. He explored that part of the Nan-shan mountains which separates the country drained by the Hoang-ho from the plains of southern Mongolia. It is composed of three mountain ranges, with passes 12,800 feet in height, and intermediate valleys at an elevation of 10,000 feet. On his way north he fell in with the Jegurs, a tribe hitherto unknown. Potanin surveyed the whole country he traveled over, and determined the position of seven places by astronomical observations. His companion, the naturalist Beressowski, will stay near Kiachta until next winter in order to complete his collections.

Mr. E. Michaelis, in *Nature* of Dec. 16, states that traces of the ice-period are found in the southern parts of the Altai Mountains. Farther

south, on the northern declivity of the ranges Jarbagatay and Saoor, which form the southern limits of the basin of the Irtish, large deposits of bowlders are found. They consist of granitic rocks, which have been carried by the ice from the crest of the mountains to a distance of about ten miles, the layer having a direction from south to north. The range of Saoor attains a height of about 12,500 feet above the level of the sea. At the present period snow always lies on its highest parts, but no glaciers are found.

According to Nikolsky, Lake Balkash is drying up at the rate of one metre in fourteen or fifteen years. Its southern portion, called Ala-Kul, is being transformed into a salt-pan similar to Kara Bugas, the well-known bay on the east side of the Caspian Sea. As the evaporation is very rapid in those regions, and the bays have no tributaries, the loss of water is replaced by the salt water of the lake rushing through the narrow entrance into the bay, the water of which having become concentrated, the salt is continually being precipitated at its bottom. Some other lakes of West Siberia and the Aralo-Caspian region are also drying up. Jadrienzew, by comparing the extent of the Lakes Suny, Abyshkan, Moloki, and Chany, in the governments of Tobolsk and Tomsk, as represented in maps of 1784, 1813–20, 1850–60, and 1880, proves that they are desiccating at a rapid rate. Lake Abyshkan measured 530 square miles at the beginning of this century, while only three small ponds of one and a half miles in width remain. The same process is going on throughout West Siberia.

According to the *Novoe Vremya*, the trading caravan lately despatched by the Central Asian commercial company Koudrine has passed through Kashgar and entered Thibet. This company is likely to play an important part in Central Asia. It has established permanent agencies at Merv and Askabad, and in the Persian cities of Kutchan and Meshed, and now it proposes to do the like in Thibet. It has received from the Ameer of Bokhara a large tract of land on the banks of the Amu-daria, near the Chardjui station of the Transcaspian railway, for the cultivation of cotton. In the Transcaspian there seems to be a great district suitable for cotton-growing, and there is a general opinion among the commercial classes of Russia that the development of this industry ought to be steadily encouraged by the government.

### *Africa.*

Further news has been received from Dr. Oscar Lenz, dated Kibonge, April 20, Nyangwe, May 19, and Kasonge, June 1. Lenz left Stanley Falls on March 30 in canoes supplied by the famous Arabian trader, Tippo-Tip, who sent several Zanzibari soldiers with him, and gave him about twenty negroes for oarsmen. At the cataracts they had to hire natives, as the work was too hard for the small company. Having left Stanley Falls, they passed through a dreary country, the banks of the river being low and covered with thick forests. On account of high water they had great difficulty in finding places for camping. Lenz found many of the native villages mentioned by Stanley deserted, as the natives had settled farther inland to escape the attacks of the Arabs. He met Zanzibari soldiers belonging to Tippo-Tip's troops in most of the villages, who gave him some trouble by trying to tax him. It took the small caravan seven days to pass the cataracts of Wamanga, having several times to transport their bulky canoes over marshy, bush-covered ground. On April 15 they reached Kibonge, which is largely inhabited by Arabs and Zanzibaris. It is named after the chief who established the village nine years ago. He came from Nyangwe, and is independent of Tippo-Tip. The village is very extensive, and is composed of a great number of ranches, with gardens and fields. Its situation, however, is very unhealthy, as it is built on the low banks of the Kongo, and large lagoons and swamps surround it. As the district is very suitable for rice culture, the Arabs have cleared the land, and grow considerable quantities of rice. Lenz considers these fields far more extensive and numerous than those in West Africa. He left Kibonge in company with several Arabian traders, who were going to Tippo-Tip's station, Riba-Riba. A few days' journey above Kibonge they heard the sounds of the war-drums of the natives, and prepared for defence in case of an attack. Wherever the Arabs have settled, the negroes have fled into the woods, and when they have a chance of attacking the intruders with safety they do so, and the Arabs are in constant fear of their poisoned arrows. The feeling of uneasiness did not subside until they had reached the friendly tribes near Riba-Riba. The latter place derives its name also from its chief, a Nyangwe negro. The river between Nyangwe, and Riba-Riba, and Kibonge is frequented by travelling parties going from one place to another in pursuit of their trade. They extend their journeys far up the tributaries of the Kongo, as far south as Urua, south-west of the Tanganyika. Nyangwe is built on a hill about a hundred feet above the Kongo. It consists of a number of houses surrounded by gardens. The inhabitants are rich Arabian merchants and Zanzibaris and natives who are in their employ. Some houses are well built of sun-dried bricks and have fine piazzas. Kasonge, the headquarters

of Tippo-Tip, is far more important than Nyangwe, being the place where caravans to Lake Tanganyika are fitted out. Tippo-Tip, whom Lenz had left at Stanley Falls, arrived at Kasonge about the time of Lenz's arrival, and as he was going to Zanzibar, Lenz feared that he would not be able to get a sufficient number of men for his caravan. Later telegraphic news informs us that Lenz was compelled to abandon his intention of reaching Dr. Junker and Emin Pacha (Dr. Schnitzler), and a short time ago the cable informed us of his arrival at Zanzibar. He has crossed the continent from the mouth of the Kongo to Zanzibar in less than eighteen months.

Lenz's remarks on the Arabian trade with Urua are of interest when compared with the views Captain Cameron expressed at the London institution, on Jan. 11, 1887. While Lenz emphasizes the difficulty the Kongo Free State and other European powers will encounter by Tippo-Tip's powerful influence in Kasonge and Urua, Cameron thinks that, by following the Lomami, the London missionary society's agents and the officers of the Kongo Free State would soon reach this country, and he expresses great hopes of their being able to do away with the horrors of the slave trade which prevails there owing to the Portuguese and Arabs.

Lieutenant Webster, late commander of the station of Stanley Falls, proposes to explore the district between Adamaua and Kameroon. This is the region which Robert Flegel tried to enter from the upper Benuë. Here the unknown area almost extends to the coast, and the obstacles arising from the hostility of the native tribes have hitherto prevented all explorers from entering the continent.

The Italian traveller, A. Franzoj, has determined to abandon his intention of crossing the Somal country, on account of the unsettled state of affairs in that district. He will go to Zanzibar, and proposes to follow Thomson and Fischer's route through the Massai district.

Dr. K. Jühlke, of the German East-African company, was murdered in Kismayu in the beginning of December. After having purchased Usagara and the neighboring countries in 1884, he added to the possessions of the company, in June and July, 1885, the district as far north as the Kilimanjaro, and, on his last expedition, that from Vitu to the mouth of the Yuba.

Captain Rouvier, member of the joint commission of France and the Kongo Free State for determining the boundary line of the possessions of both states up to longitude 17° E., has made a survey of his routes, which, it is hoped, will be a great advance in our knowledge of the geography of the Kongo River. His observations show that Stanley Pool is far smaller than it was supposed to be, and that the positions of many places and rivers require changing.

Henry M. Stanley left Suez on Feb. 6, on the steamer Navarino, for Zanzibar direct.

The German East-African company has been converted into a corporation by a committee of the founders, merchants, and financiers. The board of directors will hereafter consist of twenty-seven members, three of whom are to be nominated by Prince Bismarck. The capital is to be raised to 5,000,000 marks by a further issue of shares.

*America.*

Dr. P. Ehrenreich and K. von Steinen sailed from Hamburg last week for Brazil. They intend to explore the southern tributaries of the Amazon.

*Oceans.*

At a meeting of the Paris Academy of sciences on Jan. 10, a report was given of experiments made by the Prince of Monaco to determine the direction of the North Atlantic currents. Of 169 floats thrown overboard 300 miles north-west of the Azores, in 1885, 14 have been recovered, showing a general south-easterly direction and a mean velocity of 3.83 miles per 24 hours. Of the 510 floats thrown overboard in 1886, much nearer the French coast, 9 have been recovered, showing nearly the same direction, with velocities of from 5.80 to 6.45 miles.—*Nature*, Jan. 20.

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## *NOTES AND NEWS.*

THE plans of the Johns Hopkins university have always had reference to the establishment of a faculty of medicine whenever the Johns Hopkins hospital should be completed. The buildings are nearly ready to be occupied, and arrangements will be perfected for instruction in surgery and medicine. Meanwhile, courses preliminary to the study of medicine, especially in physics, chemistry, and biology, with the modern languages, are provided in the philosophical faculty. The nucleus of the medical faculty, as now constituted, includes the president of the university, a professor of pathology, a professor of physiology, a professor of chemistry, a lecturer upon hygiene, and an associate in pathology.

—During the past year the Institute of social science of New York has held twenty meetings, at which were presented and discussed the following papers: 'The logical method of studying sociology,' Mr. Parke Godwin; 'An introduction to social science,' T. B. Wakeman, Esq.; 'Principles that should control the interference of the state in

industries,' Dr. H. C. Adams; 'The fiscal problem of all nations,' Prof. J. C. Zachos; 'Neglected factors in social reform,' Rev. Dr. A. H. Bradford; 'English socialism, especially co-operation, and the Christian socialistic movement,' Dr. E. R. A. Seligman; 'Heredity and opportunity,' Dr. Lester F. Ward; 'Criticism of Seligman's paper,' Mr. Edward King; 'The land question as presented by Mr. Henry George,' Professor Molina; Discussion of Dr. Adams's paper of April 8; 'Karl Marx's theory of value,' Mr. Ewald Langerfeld; Discussion continued of Dr. Ward's paper of June 10; 'The demands of labor,' Mr. Edward King; 'Free competition *vs.* state socialism,' Mr. Justus O. Woods; 'The moral aspect of the economic question,' Prof. Thomas Davidson; 'A practical view of protection,' Mr. Robert P. Porter; 'The basic law of ownership,' Mr. Edward G. Clark; 'The cause and cure of crime,' Mr. W. M. F. Round; 'The economic heresies of Mr. Henry George,' Mr. George Gunton. The papers generally were very meritorious, and several of them were published in the leading periodicals and journals, and others in pamphlet form. The institute has thus aided in elucidating social topics which are commanding so general and pressing public attention. One member of the institute has successfully organized two popular classes for the systematic study of social economics, and others are being formed. Three or more of the members are preparing books on this subject for publication. Those who have followed carefully the papers and their discussion bear emphatic testimony to their usefulness. It is worthy of remark that the result of the discussions has been favorable to conservative opinion, and proves that healthful social progress will come through a more general and better understanding of the principles underlying social economics. The discussion of the papers has taken sometimes too much the form of debates, in which the contention seemed rather for victory than truth. Disputants have not always confined themselves to the topic discussed, but have disputed with each other points not involved in the papers.

— Strenuous efforts are being made to induce the legislature of the state of New York to enact the amendments to the present tenement-house law of the city of New York, which were prepared by the tenement-house commission of 1885. The act provides that every tenement shall have a dry cellar, good drainage, ample water-supply, and a janitor; owner's name to be registered; a semi-annual inspection by the board of health, and an annual report; free winter baths; electric lights in tenement district; and cutting through Leonard Street to open up the Mulberry Street 'bend.' Petitions are now being circulated in behalf of this law. The citizens of Brooklyn are also moving in the matter of tenement-house reform, the law in that city being practically the same as it was twenty years ago, and the tenement-houses lacking many of the improvements which are to be found in New York. The amended ordinances which were forwarded to the common council of Brooklyn nearly two years ago still remain unacted upon, and efforts are now being made to have them adopted by that body. For this purpose a meeting has been called by the commissioner of health, of builders, architects, physicians, and philanthropists, to consider and revise these ordinances before their final adoption.

— Mr. H. C. Russell, government astronomer for New South Wales, and late president of the Royal society of that colony, gave an account in his last presidential address of certain oscillations, or *Seiches*, as the Swiss call them, in the waters of Lake George (New South Wales), as determined by the record of an automatic evaporation gauge. The lake is about eighteen miles long, five wide, and fifteen or twenty feet deep: its oscillations have an amplitude of from two to six inches, and are of two periods; the longer being two hours and eleven minutes, the shorter one hour and twelve minutes. In most cases the motion is connected with the passage of thunder-storms; but at other times it seemed to arise from the repeated and well-timed impulses of a less apparent force. For example: on one occasion, when the lake was very quiet, the water suddenly rose an inch, and fell again within thirty minutes; then it rose an inch and a half, and fell two inches in three-quarters of an hour; next it rose two inches, and fell three and a half inches in an hour; finally it rose three and three-quarters inches in forty minutes, and so started a series of pulsations which settled down to two-hour intervals, and lasted twenty hours.

— The Society of arts, England, offers two gold and four silver medals for the best motors suitable for electric-light installations, to be competed for in London next May or June. The motors will be divided into two classes, — those in which the working agent is produced (steam and gas engines), and those in which the working agent must be supplied (steam, gas, and hydraulic engines).

— The following is a copy of a note found by Mr. J. C. McClure on the south side of Nantucket, Jan. 29, 1887: "This bottle was thrown overboard from schooner Emma L. Cottingham, July 20, 1886, in latitude 41° 06′ north, longitude 69° 08′ west. Any person finding this will confer a favor by

sending this to the hydrographic office at Washington, D.C., stating when and where found." The note was signed "J. L. Somers, schr. Emma L. Cottingham, of Somers Point, N.J."

— Three more sheets of the topographical atlas of New Jersey are issued, making thirteen out of the seventeen for the whole state. The new sheets are named after their chief places, Trenton, Mount Holly, and Camden. The remaining sheets will probably be completed in 1888.

— The report of Lieut. William H. Schurtze, U.S N., on his official trip to Russia to distribute the testimonials of the government to the subjects of Russia who extended aid to the survivors of the Jeannette exploring expedition, was presented to congress last week. The report is quite long, and records in detail the movements of the lieutenant and the results of his observations. Accompanying the report are copies of two charts the existence of which Lieutenant Schurtze believes have been forgotten outside of Russia. He says, in view of the general interest taken in anything pertaining to the Jeannette expedition, it seems that these charts are worthy of special consideration, because they relate directly to two regions most prominent in the history of the expedition, namely, Bennett Island and the Lena Delta, North Siberia.

— The U. S. coast and geodetic survey report for 1885 — Appendix No. 10 — contains a paper by Charles O. Boutelle, who gives practical suggestions for geodetic reconnaissance, such as he derives from his long experience in field-work. His information on the selection of base-lines and stations for triangulation will be useful for topographers.

— In 1882 small-pox was very prevalent in New York, there having been 708 cases with 259 deaths. In 1883, only 26 cases and 12 deaths occurred ; in 1884, 5 cases and no deaths ; in 1885, 105 cases and 26 deaths ; and in 1886, 109 cases and 31 deaths. During the week ending Jan. 29 of the present year, there were 23 cases, of which 3 proved fatal.

— The health commissioner of Denver, Col., reports that in 1886 there were 195 deaths from consumption in that city, only five of which originated in the state of Colorado.

— The U. S. geological survey is engaged in the preparation of a detailed topographical map of the vicinity of Washington, Alexandria, and contiguous parts of Maryland and Virginia. It is intended to show the elevation by contours at twenty-five feet intervals, showing the curvature of the earth as it rises from the sea-level The existing coast-survey work in this neighborhood will be incorporated in the new map. This will be the first authentic topographical map, on a trigonometric basis, of the District of Columbia and its surroundings. The coast-survey steamer Hassler arrived at the Mare Island navy yard last week, and will soon go north to the Alaska coast and resume work in that vicinity.

— Dr. Hinrichs has lately published a comparison of the weather-predictions of the signal service for last August, as indicated by flag-signals hoisted at Iowa City, with the weather occurring in the period for which the predictions were made, getting the following results :—

| *Predictions.* | *Facts.* |
|---|---|
| Colder, 7 days | 3 days, average difference from preceding noon, 3°.3 colder.<br>4 days, average difference, 4°.0 warmer. |
| Stationary temperature, 13 days | 8 days, average difference, 3°.6 colder.<br>5 days, average difference, 4°.8 warmer. |
| Warmer, 8 days | 3 days, average difference, 3°.6 colder.<br>4 days, average difference, 1°.8 warmer.<br>1 day, no change. |
| Local rain, 11 days | 2 days, no rain.<br>4 days, rain not measurable.<br>3 days, rain barely measurable.<br>2 days, appreciable rain. |
| Fair weather, 20 days | 2 days, appreciable rain.<br>1 day, violent thunder-storm, with heavy wind and rain (others not mentioned). |

Dr. Hinrichs concludes that it is exceedingly unfavorable to the people's confidence in the flag-display of the signal service, when its fair-weather flag is beaten by storm and rain, and when its rain-flag flutters lustily and dryly in a hazy, balmy atmosphere of summer.

— A valuable Algonquin-French lexicon (*Lexique de la lanque Algonquine*) by the distinguished philologist, the Rev. J. A. Cuoq, has lately been published (Montreal, J. Chapleau et Fils). The Algonquin, as the name is here used, is the language of that tribe of Indians who formerly possessed the country about Montreal, and of whom some bands still remain in the neighborhood of that city. Their speech has a special importance, both scientific and historical. As in the case of the author's Iroquois lexicon, there are interesting notes, linguistic and ethnological, on almost every page. The volume lacks the French-Algonquin part. It is to be hoped that the industrious author will hereafter supply this deficiency, as well as the similar lack which detracts from the usefulness of his excellent Iroquois lexicon.

— Prof. Max Müller's volume on 'The science of thought,' on which he has been engaged at intervals for several years, will soon be published. The author is occupied in it with the origin of

speech, which in his view, as in that of the Greeks, is identical with thought. A contribution of this sort to metaphysical science, from a writer who is at once a profound philologist, an able annotator of Kant, and the master of a most lucid and happy English style, will be expected with general interest.

— 'Harvard and its surroundings' (Boston, *Rand Avery Co.*, 1886), of which the seventh edition has just been issued, is designed to take the place of an intelligent companion to the visitor in his walk through Harvard and its vicinity, giving brief yet sufficiently definite descriptions of every place visited, with passing allusions to its leading historical and biographical associations, and devoting the larger proportion of space to the specially noteworthy objects.

— The *Athenaeum* prints the following: "The bibliography of learned societies is being enriched by a couple of useful publications now coming out in sections, — 'Die Wissenschaftlichen Vereine und Gesellschaften Deutschlands im 19 Jahrhundert,' by Dr. Joannes Müller; and the 'Bibliographie des Travaux Scientifiques et Archéologiques publiés par les Sociétés Savantes de la France,' published under the auspices of the minister of public instruction. Now, Mr. A. P. C. Griffin, of the Boston public library, proposes to issue by subscription a 'Bibliography of American historical societies.'"

— We learn from the *Athenaeum* that three important libraries of deceased professors have lately been sold in Berlin, — that of Professor Scherer, which was bought for 28,000 marks by an American university; that of the historian Waitz, which fetched 16,000 marks; and that of Professor Müllenhoff, which has been purchased for the new Germanische Seminar of the University of Berlin. Scherer's library is reported to have been one of the finest private collections in Germany.

— Kleiber of St. Petersburg has lately computed, in the *Meteorologische Zeitschrift*, the half-yearly variations of atmospheric pressure in the two hemispheres, taking January and July for the months of extreme conditions. He finds the mean pressure for the whole earth 759.20 mm. This result is necessarily the same for the extreme months, and the agreement of the author's figures serves as a check on his work. The mean pressure of the northern hemisphere is 760.31, varying from 761.80 in January to 758.82 in July: for the southern hemisphere, the figures are 758.09, 756.60, and 759.58. The mean pressure in the northern hemisphere thus exceeds that in the southern by 2.22. In July, when the northern atmosphere is expanded and flows off to southern latitudes, the average northern excess is reversed to a slight deficiency of 0.76; but in January, when the cold of the land hemisphere is extreme, it accumulates more air than usual, and its excess rises to 5.20. It may therefore be said that a mass of air, equivalent to that which would give a pressure of 5.96 over a hemisphere, is periodically transferred from one side of the equator to the other.

— The report of the U. S. geological survey on the mineral resources of the United States for 1885 contains some interesting statistics. The total mineral product is valued at $428,521,356, an increase of $15,306,608 over 1884. Among seventy mineral substances cited, coal is the most important, showing a total value of $159,019,596. An increase is shown in the production of coke, natural gas, gold, silver, copper, zinc, quicksilver, nickel, aluminum, lime, salt, cement, phosphate rock, manganese, and cobalt oxide, while the production of coal, petroleum, pig-iron, lead, precious stones, and mineral waters decreased. From the present outlook, says the report, it is probable that the total output of 1886 will prove much greater than that of 1885, and even larger than the prosperous year of 1882.

— A very valuable contribution to the study of cerebral localization is made by Dr. Henry Hun in the *American journal of the medical sciences* for January, 1887. The article records seven unusually interesting cases in which the symptoms were observed during life, and the lesions of the brain carefully examined after death. The results corroborate many of the current views on localization, and in a few points carry the process further than was possible before.

— The year 1886 has added eleven new asteroids to the list, which now numbers 264. Seven of the strangers were discovered by Dr. J. Palisa of Vienna, who has found no less than fifty-seven in all, while three were discovered by Dr. Peters of Clinton, who is now credited with forty-six. No. 258, Tyche, was found by Dr. R. Luther of Düsseldorf. No. 254 has been named Augusta; 255, Oppavia; 257, Silesia; 259, 260, 261, Aletheia, Huberta, and Prymno, respectively. The remaining four are still unnamed.

— The duplex principle has been successfully adapted to the Phelps system of inductive telegraphy, so that messages may be sent to and from moving trains in the ordinary manner without interfering with the transmission of messages by induction. With this improvement, a single line is all that is required for both train and ordinary telegraphy.

## LETTERS TO THE EDITOR.

### German constructions.

I DISAGREE *toto coelo* with my learned fellow-citizen as to what he is pleased to call 'horrible construction' in German, but believe, on the contrary, that for one whose ear is trained to it the sentences of qualification are as clear as an assemblage of short phrases, and ever so much more powerful. As an example of the involved style (seldom if ever used by the best German writers and speakers, by the way), take this: —

Dem, der den, der die, das Verbot enthaltende Tafel abgerissen hat, anzeigt, wird hierdurch eine Belohnung zugesichert.

This is tough for the anti-Teuton, but it says in eighteen words and ninety-five letters what cannot be literally translated into English in less than nineteen words and one hundred and four letters.

PERSIFOR FRAZER.

Philadelphia, Feb. 8.

### Inertia-force.

Will you allow me to draw attention to one point in Dr. E. H. Hall's recently published pamphlet on 'Elementary ideas, definitions, and laws in dynamics,' which he seems to me to have treated with less success than he has the other points raised?

On p. 6 Dr. Hall says, "We have spoken sometimes of the force which *is applied* to a body to change its motion, and sometimes of the resistance or counter-force with which the body meets the applied force. Each is necessary to the other. We could not exert force upon a body if the body offered no resistance. On the other hand, resistance would be impossible if there were no applied force to be met. We shall call the counter-force, which a body in virtue of its inertia exerts to meet a force applied, the *inertia-force*." On what body this counter-force is supposed to be exerted is not at once clear. At first it seemed to me to be the body by which the applied force was exerted, the applied force and the counter-force being thus the opposite aspects of the same stress. And this seemed especially probable from the fact that on p. 24 the third law of motion (which of course applies only to the two opposite aspects of one stress) is cited to prove the equality of the applied force (there treated as doing work) and the counter-force (there called a resisting force). But the following quotations show that this is not Dr. Hall's meaning: "The force, or resistance, exerted by a body varies greatly with the conditions of the experiment, being sometimes large, sometimes small, according to the following general law: When the ball's motion is changed slowly, it offers a slight resistance, — a small force suffices; when a considerable change is to be effected in a short time, we encounter a large resistance, — a great force is required" (p. 5); and, "There is no change of motion, and hence no inertia-force is developed" (pp. 6 and 7). The counter-force may thus become zero, though the stress still act; and hence it cannot be one aspect of that stress. The following quotation, however, seems to settle the matter: "If one of the opposing applied forces is greater than the other, the greater will prevail, and a change of motion will occur, occasioning an inertia-force, which will work *with* the smaller applied force *against* the greater" (p. 7). The inertia-force, therefore, is supposed to act on the body by which it is exerted.

The magnitude of this inertia-force is determined, according to Dr. Hall (see above quotation from p. 5), by the magnitudes of the forces applied to the body; and the following quotation — "The working force and the resisting force must also be equal" (p. 24) — shows that just sufficient inertia-force is called into play in any case to satisfy the conditions of equilibrium.

Now, this sounds very like the old notion of centrifugal force. It was formerly held that a body moving with uniform speed in a circular path was acted upon not only by a force directed towards the centre of the path, and applied, say, by means of a string, but also by an equal force directed from the centre, called the centrifugal force, and exerted on the body by the body itself, which was accordingly considered to be in equilibrium. Dr. Hall's inertia-force is thus just a generalization of the old notion of centrifugal force.

Although Dr. Hall thus proposes to re-introduce what seems to be an old error, the only evidence he brings forward for his inertia-force is the assertion contained in the first of the above quotations, that, of the applied and inertia-forces, each is necessary to the other. Yet he does not leave us without means of judging of his theory of the 'resistance' which bodies offer to applied forces; for according to his own account of this inertia-force, as shown above, it both acts on, and is exerted by, the same body. Now, on p. 18 he admits that "every force implies an action between *two* bodies." Hence the supposed inertia-force cannot be a force at all. And again, as we have seen above, according to Dr. Hall's own account, all bodies must be acted upon by equilibrating systems of forces, if this inertia-force be taken into account; and therefore, if this inertia-force be a force, a body's motion may be changing though it satisfy the conditions of equilibrium.

Apparently Dr. Hall has been led to postulate this inertia-force, because, 1°, he holds that a body resists an applied force (he even takes this to be a fact given in consciousness, for he says, p. 3, "One feels that the hand is *pulling*, that it encounters a *resistance*, which is offered in some way by the ball at the other end of the string"); and, 2°, he cannot understand a force as being resisted in any other way than by the exertion of an opposing force. I agree with him that the term 'resistance' should in dynamics be restricted to the opposition of forces. But the manifest consequence is, that a body ought not to be said to resist a force, and that Maxwell's queries, quoted by Dr. Hall (p. 32) — "Is it a fact that matter has any power, either innate or acquired, of resisting external influences? Does not every force which acts upon a body always produce exactly that change in the motion of the body by which its value as a force is reckoned?" — are to be answered, as Maxwell evidently intended them to be answered, the former in the negative, the latter in the affirmative, though some of his own definitions may be thereby shown to be worded in a faulty manner.

I hope I have not misrepresented Dr. Hall's position. I have read his pamphlet carefully several times, and can get only one meaning out of it. Were I reviewing the pamphlet, I would find many points to praise; and I draw attention to the above apparent error only because the excellence of the pamphlet generally is likely to cause it to take root and spread.

Dr. Hall, in his appendix, quotes a passage from Minchin's 'Uniplaner kinematics' which seems to

show that he has high authority for his inertia-force. But that Newton's *vis insita* or *vis inertiae* is quite a different thing from Hall's inertia-force, will be evident from the following quotations: "Haec" [vis insita] "semper proportionalis est suo corpori, neque differt quicquam ab inertia massae, nisi in modo concipiendi" (Newton's *Principia*, comment on def. III); and "Inertia and inertia-force must be carefully distinguished" (Hall's pamphlet, p. 6). Minchin's 'force of inertia' is just D'Alembert's 'effective force,' and is not a force at all, but simply the name given to the product of the mass of a particle into its acceleration. J. G. MACGREGOR.

Halifax, Jan. 31.

## An Ohio mound.

In company with five young men from the public school of this place, on Saturday, Oct. 10, 1886, I assisted in the exploration of a mound, located in the northern part of Van Buren township, Shelby county, O., an account of which may be of interest to antiquarians.

Twenty-five years ago the mound was ten feet high, and twenty feet in diameter at its base. It was opened at that time by a Mr. Robinson, the owner of the farm, and a neighbor, but nothing was discovered by them beyond the fact that it contained a deposit of the fragments of bones, ashes, and red earth. A more careful examination, however, made by digging a trench four feet wide through it from east to west, revealed the fact that it was not only a place of deposit for dead bodies, but a place where human bodies were consumed by fire. A large portion of the interior of the mound is composed of calcined bones. Many of these bones, since their calcination, have been filled by carbonate of lime, and are now as hard and heavy as stone. There were, no doubt, a few copper implements or ornaments deposited with the bodies, as the bones are all highly colored with the salts of that metal. A careful examination, however, failed to discover specimens of the metal. A quantity of mica, sufficient to give the *débris* a glittering appearance, was found diffused through the entire mass. Deposits of red clay were found in different portions of the mound, of a deeper red than the red color produced by the action of fire.

One curious feature of the contents of the mound was the large number of balls found, varying from a half-inch to two inches in diameter. They have all been burned, and are of about the hardness of soft-burned bricks. The only relics found were a few small fragments of pottery and a green slate tablet three inches long, pierced by a hole at one end.

C. W. WILLIAMSON.

New Bremen, O., Feb. 3.

## A method of labelling museum specimens.

The task of so labelling a collection of rocks, minerals, or similar objects, that their identity can in none but the most extreme cases be lost, is no light one. A common method now employed consists in painting a small area upon the object, which serves as a background upon which the serial number is again painted in a different color. Although the results thus obtained are lasting, the method is too laborious. Another common method consists in writing the requisite data with pen or pencil upon a slip of paper, which is then gummed to the specimen. This is, however, worthy only of universal condemnation.

After several years' experience in dealing with rock collections, I have adopted the plan given below, which is but a modification of that first mentioned. Its advantages are, ease and rapidity in application, legibility, and durability of results. The method, then, is briefly this: take common lead paint, of any desired color, and mix with ordinary varnish and a very little turpentine instead of oil. Apply with a brush over an area sufficiently large to accommodate the catalogue number, or whatever data it may be desired to put upon it. This quickly dries, giving a smooth, glossy surface. With very vesicular rocks, as some of the recent lavas, it is often best to even the surface by means of a little plaster-of-Paris, applied with a knife-point, before painting the stripe. Then take tube paints, — I use Winsor & Newton's lamp-black, — mix thin with turpentine, and with this and a common steel pen write the number on the surface prepared as above. If the paint is just the right consistency, — and this can be learned only by experience, — the numbers can be written almost as rapidly as with a pencil on paper. Both paints had best be mixed in watch-glasses, or some shallow vessel that can be readily cleansed, as they are, of course, useless after once having become hard and gummy.

On colorless crystals, such as quartz, the number can, perhaps, be best written with a marking-diamond. On smooth dressed specimens, as polished marble, the numbers can be written with pen and paint without the first stripe. On account, however, of the great diversity in color and texture of materials, I have found it best to adopt a uniform system for all, — a light-blue base with figures in black. Any other sufficiently contrasting colors will, of course, do as well. GEORGE P. MERRILL.

U.S. nat. mus., Feb. 5.

## Fish parasites in Meleagrinae.

The occurrence of parasites or commensals in the pearl-oysters or mother-of-pearl shells has been known for a long time. Several years ago (1874), Professor Putnam of Cambridge described, in the Proceedings of the Boston society of natural history, Fierasfer dubius, a small fish common to both coasts of Central America, which sometimes inhabits holothurians on the Atlantic, and pearl-oysters on the Pacific side; and he referred to a specimen of the pearl-oyster in the Museum of comparative zoölogy, in which a Fierasfer is embedded in the nacreous substance of the shell.

In June last Dr. Gunther, at a meeting of the Zoölogical society (London), exhibited a similar specimen.

About a year ago, while examining certain material belonging to the Mexican geographical commission, I detected probably the same species enclosed in nacre in a pearl-oyster valve from the Gulf of California, and two, if not three, instances of another species of fish, apparently an Oligocottus (in the opinion of Dr. Bean), similarly enclosed. The occurrence of a crustacean, the pea-crab (Pinnotheres), under the same conditions, in a pearl-oyster shell from Australia, was made known to the Zoölogical society last April by Dr. Woodward. The forthcoming report of the national museum will contain a

more ample description with figures of these interesting parasites or commensals.

ROBT. E. C. STEARNS.

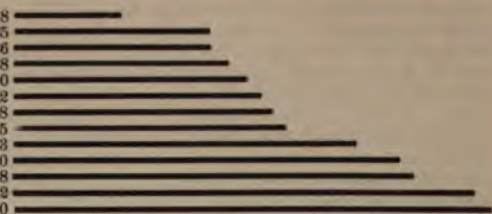
U. S. nat. mus., Washington, Feb. 2.

## National prosperity.

My attention has been called to the comments of Mr. C. H. Leete upon my January article in the *Century magazine*. Mr. Leete objects to making the year 1865 a basis for the comparison of progress. The details of each year were given, and he could choose for himself any year in the series from which to date progress. Perhaps it may be interesting to submit the enclosed more ample table, showing progress from 1870 up to the present date. In respect to cotton, the ante-war crops are given as well as the post-war crops. The gain subsequent to the war, as compared to the twenty-one years previous to the war, has been much greater than before, for the reason that for every cent per pound added to the price of cotton under the slave system, $100 was added to the price of an able-bodied slave. The planters could not buy labor fast enough to keep up with the demand. This principle was completely stated in *DeBow's review*; and it was one of the causes which induced the extreme pro-slavery men of the south to attempt to re-open the slave-trade before the war.

*Per centum of gain in population, production, wealth, and savings,* 1870 *to* 1885, *and on some items to* 1886.

| To | | |
|---|---|---|
| 1885, | population | 48 |
| " | production of grain | 85 |
| " | consumption of cotton | 86 |
| " | consumption of wool | 88 |
| " | production of hay | 100 |
| " | deposits in savings banks of Massachusetts | 102 |
| " | production of cotton | 108 |
| 1886, | deposits in savings banks of Massachusetts | 115 |
| 1885, | production of iron | 143 |
| " | insurance of property against loss by fire | 160 |
| " | miles of railroad | 168 |
| 1886, | miles of railroad | 192 |
| " | production of iron | 200 |



Mr. Leete calls attention to the retardation in the gain of population since the war as compared to the previous period from 1850 to 1860. It does not require much thought to comprehend the reason of that retardation.

Mr. Leete asks why progress and wealth may not be predicated on the assessed value of real and personal property. I have endeavored to prove progress in the accumulation of capital without including land. People do not insure land against loss by fire, only property of other kinds. Moreover, the census figures of the past upon these points are all rubbish, as every expert of the census well knows.

It strikes me that Mr. Leete makes a good example of the common saying about statistics, — that one can twist the figures, if he chooses, so as to prove any thing that he desires to prove. No one comprehends this better than the man who is accustomed to compile statistics. The value of statistics depends wholly upon the motive with which they have been gathered, the purpose for which they have been compiled, and an exact regard to truth.

In considering these relative gains, it will be observed that they represent a constant gain in the means of subsistence over population; that, with the exception of the increase in personal wealth, which is indicated by the increase in the amount of property insured against loss by fire, they represent the progress of the million in the means of common welfare rather than of the millionnaire in personal wealth; and that they give testimony to the beneficent law of progress *from* poverty.

EDWARD ATKINSON.

Boston, Feb. 7.

## Youthfulness in science.

Your artice upon 'Youthfulness in science' (*Science*, ix. No. 209) illustrates a most radical defect in our educational system. It does not seem to be the chief purpose to incite the student to weigh evidence and secure accurate knowledge, prizing above every thing the ability to form correct judgments in regard to the significance of observed facts. It is not even assumed that he can have any other feeling in his studies than a selfish desire for personal renown or advancement, respect for or love of truth and knowledge for their own sake being entirely out of the case. Instead of being taught to profit by criticism, he is led to dread it. Moreover, he finds that his educators, instead of admitting frankly that to err is human, and that all alike must learn to profit by their mistakes, are apparently most concerned in seeking to maintain a reputation for infallibility by contributing nothing whatever to the advancement of knowledge. It is not strange that progress is slow where such a spirit prevails.

M. A. VEEDER.

Lyons, N.Y., Feb. 5.

## Germ of hydrophobia.

I have not observed in your columns a reference to what appears to be an exceedingly important communication by Professor Fol, of Geneva, to the Swiss natural history society, with regard to the bacillus of rabies, which he claims to have isolated.

According to the *Biologisches centralblatt* (Dec. 51), Professor Fol finds that turpentine (even water which has been shaken up with turpentine) acts as an effective germicide when added to pure cultures of this bacillus, and that it is even more effectual than a one per cent solution of corrosive sublimate. He considers, consequently, that turpentine might be used as a substitute for the actual cautery in the treatment of recent bites, especially in places such as the face, where the cautery would produce great disfigurement. No suggestions are made as to application, but if experiments on animals should justify Professor Fol's view, it would be desirable to give it as wide publicity as possible.

R. RAMSAY WRIGHT.

Univers. coll., Toronto, Feb. 3.

## Calendar of Societies.

*Biological society, Washington.*

*Feb.* 5. — William T. Hornaday, The last of the buffalo; Richard Rathbun, Ocean temperature charts in connection with studies in geographical distribution; C. Hart Merriam, Contributions to North American mammalogy; Description of a new species of wood-rat (Neotoma); Henry W. Elliott, Ridgway's nomenclature of colors for naturalists; L. Stejneger, Exhibition of new species of birds from the Sandwich Islands; Tarleton H. Bean, Variation under domestication of the rainbow trout (with exhibition of specimens).

*Anthropological society, Washington.*

*Feb.* 1. — James C. Welling, The 'law of Malthus' inductively investigated.

*Institute of social science, New York.*

*Feb.* 10. — T. D. Crothers, The cause and the cure of inebriety.

*American academy of arts and sciences, Boston.*

*Feb.* 9. — Oliver W. Huntington, On the Coahuila meteorites; William M. Davis, The Chinook wind and its effect on the isotherms and isobars of the daily weather-map.

*Appalachian mountain club, Boston.*

*Feb.* 9. — W. O. Crosby, Elevated potholes near Shelburne Falls; Edwin T. Horne, A short description of the new path to Bald Cap.

*Society of arts, Boston.*

*Feb.* 10. — Mr. Dwight Porter, The water-power of the United States.

*Feb.* 24. — Dr. E. D. Peters, The Bessemerizing of copper mattes.

### Publications received at Editor's Office, Jan. 31-Feb. 5.

AGRICULTURAL science, January, 1887. Vol. i., No. 1. Geneva, N.Y., C. S. Plumb. 24 p. 8°. *m.*

AMERICAN association for the advancement of science. proceedings of the thirty-fifth meeting of the, held at Buffalo, N.Y., August, 1886. Salem, A.A.A.S. 392 p. 8°.

ARCTURUS: a Canadian journal of literature and life. Toronto, J. C. Dent. 16 p. 4°.

BLISS, J. A. The history of the discovery of transfacial mediumship. South Boston, National developing circle. 46 p. 32°.

BUGBEE, J. M. The city government of Boston. (Johns Hopkins univ. studies, fifth series, iii.) Baltimore, Johns Hopkins univ. 60 p. 8°.

DU FIEF, J. La densité de la population en Belgique et dans les autres pays du monde. Bruxelles, Vanderauwera. 53 p. 8°.

FULLERTON, G. S. The conception of the infinite, and the solution of the mathematical antinomies: a study in psychological analysis. Philadelphia, Lippincott. 131 p. 12°. $1.

HAGEMANN, G. A. Studien über das Molekularvolumen einiger Körper. Tr. by P. Knudsen. Berlin, Friedländer. 58 p. 8°.

JOHNS HOPKINS university, Baltimore, Md., eleventh annual report of the president of the, 1886. Baltimore, Johns Hopkins univ. 100 p. 8°.

MACOUN, J. Catalogue of Canadian plants. Part iii.: Apetalae. (Can. geol. nat. hist. surv.) Montreal, Dawson. [229] p. 8°.

MACARTHUR, A. Education in its relation to manual industry. New York, Appleton. 393 p. 12°.

RIDGWAY, R. A nomenclature of colors for naturalists, and compendium of useful knowledge for ornithologists. Boston, Little, Brown & Co. 129 p. 12°.

WOEIKOF, A. Die Klimate der Erde. Teil ii. Jena, Costenoble. 422 p. 12°.

## Advertised Books of Reference.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 11, 1887.

### *THE STUDY OF GEOGRAPHY.*

It is a remarkable fact, that, in the recent literature of geography, researches on the method and limits of that science occupy a prominent place. Almost every distinguished geographer has felt the necessity of expressing his views on its aim and scope, and of defending it from being disintegrated and swallowed up by geology, botany, history, and other sciences treating on subjects similar to or identical with those of geography. If the representatives of a science as young as geography spend a great part of their time in discussions of this kind, though the material for investigations is still unlimited; if they feel compelled to defend their field of research against assaults of their fellow-workers and outsiders, — the reason for this fact must be looked for in a deep discrepancy between their fundamental views of science and those of their adversaries.

Formerly, when the greater part of the earth's surface was undiscovered, and European vessels sailed only over their well-known routes from continent to continent, careful not to stray from the old path and fearing the dangers of unknown regions, the mere thought of these vast territories which had never been sighted by a European could fill the mind of geographers with ardent longing for extended knowledge; with the desire of unveiling the secrets of regions enlivened by imagination with figures of unknown animals and peoples. But the more completely the outlines of continents and islands became known, the stronger grew the desire to *understand* the phenomena of the newly discovered regions by comparing them with those of one's own country. Instead of merely extending their study over new areas, scientists began to be absorbed in examining the phenomena more intently, and comparing them with the results of observations already made. Thus Humboldt's admirable works and Karl Ritter's comparative geography arose out of the rapidly extending knowledge of the earth.

The fact that the rapid disclosure of the most remote parts of the globe coincided with the not less rapid development of physical sciences has had great influence upon the development of geography; for while the circle of phenomena became wider every day, the idea became prevalent that a single phenomenon is not of great avail, but that it is the aim of science to deduce laws from phenomena; and the wider their scope, the more valuable they are considered. The descriptive sciences were deemed inferior in value to researches which had hitherto been outside their range. Instead of systematical botany and zoölogy, biology became the favorite study; theoretical philosophy was supplanted by experimental psychology; and, by the same process, geography was disintegrated into geology, meteorology, etc.

Ever since, these sciences have been rapidly developed, but geography itself has for a long time been almost overshadowed by its growing children. However, we do not think they can fill its place, and wish to prove that its neglect cannot be remedied by the attentive cultivation of those sciences separately.

Those accustomed to value a study according to the scope of the laws found by means of it are not content with researches on phenomena such as are the object of geography. They consider them from a physical stand-point, and find them to be physical, meteorological, or ethnological; and, after having explained them by means of physical, physiological, or psychological laws, have finished their work. It is very instructive to consider thoroughly their definition of geography. They declare that the domain of this science comprises neither magnetical and meteorological nor geological phenomena and processes. They generously grant it the study of the distribution of animals and plants, as far as physiologists and evolutionists will permit; but all agree that anthropo-geography — the life of man as far as it depends on the country he lives in — is the true domain of geography.

It is not difficult to discover the principle on which this segregation is founded. Physical phenomena are subject to physical laws which are known, or which will assuredly be found by the methods used in discovering those that are known. Physiological, and, to a still higher degree, psychological, laws are not so well known as to allow their being treated in the same way as physical laws. The conditions of the phenomena are generally so complicated, that, even if the most general laws were known, a strict conclusion cannot easily be drawn. But were those auxiliary sciences just as far developed as physics, no doubt the same scientists who at the present time concede them willingly to geography would not hesitate to claim them for physiology and psychology. It

is evident that there is no middle way: geography must either be maintained in its full extent or it must be given up altogether.

As soon as we agree that the purpose of every science is accomplished when the laws which govern its phenomena are discovered, we must admit that the subject of geography is distributed among a great number of sciences; if, however, we would maintain its independence, we must prove that there exists another object for science besides the deduction of laws from phenomena. And it is our opinion that there *is* another object, — the thorough understanding of phenomena. Thus we find that the contest between geographers and their adversaries is identical with the old controversy between historical and physical methods. One party claims that the ideal aim of science ought to be the discovery of general laws; the other maintains that it is the investigation of phenomena themselves.

It is easily understood, therefore, why in geography the contest between these views is particularly lively. Here naturalists and historians meet in a common field of work. A great number of modern geographers have been educated as historians, and they must try to come to an agreement with the naturalists, who, in turn, must learn to accommodate their views to those of the historians. It is evident that an answer to this fundamental question on the value of historical and physical science can only be found by a methodical investigation of their relation to each other.

All agree that the establishment of facts is the foundation and starting-point of science. The physicist compares a series of similar facts, from which he isolates the general phenomenon which is common to all of them. Henceforth the single facts become less important to him, as he lays stress on the general law alone. On the other hand, the facts are the object which is of importance and interest to the historian. An example will explain our meaning more satisfactorily than a theoretical discussion.

When Newton studied the motion of the planets, the distribution of those celestial bodies in space and time were the means, not the object, of his researches. His problem was the action of two bodies upon each other, and thus he found the law of gravitation. On the other hand, Kant and Laplace, in studying the solar system, asked the question, Why is every one of the bodies constituting the solar system in the place it occupies? They took the law as granted, and applied it to the phenomena from which it had been deduced, in order to study the history of the solar system. Newton's work was at an end as soon as he had found the law of gravitation, which law was the preliminary condition of Kant's work.

Here is another example: according to Buckle's conception, historical facts must be considered as being caused by physiological and psychological laws. Accordingly, he does not describe men and their actions as arising from their own character and the events influencing their life, but calls our attention to the laws governing the history of mankind. The object of the historians is a different one. They are absorbed in the study of the facts, and dwell admiringly on the character of their heroes. They take the most lively interest in the persons and nations they treat of, but are unwilling to consider them as subject to stringent laws.

We believe that the physical conception is nowhere else expressed as clearly as in Comte's system of sciences. Setting aside astronomy, which has been placed rather arbitrarily between mathematics and physics, all his sciences have the one aim, to deduce laws from phenomena. The single phenomenon itself is insignificant: it is only valuable because it is an emanation of a law, and serves to find new laws or to corroborate old ones. To this system of sciences Humboldt's 'Cosmos' is opposed in its principle. Cosmography, as we may call this science, considers every phenomenon as worthy of being studied for its own sake. Its mere existence entitles it to a full share of our attention; and the knowledge of its existence and evolution in space and time fully satisfies the student, without regard to the laws which it corroborates or which may be deduced from it.

Physicists will acknowledge that the study of the history of many phenomena is a work of scientific value. Nobody doubts the importance of Kant's researches on the solar system; nobody derogates from that of investigations upon the evolution of organisms. However, there is another class of phenomena the study of which is not considered of equal value, and among them are the geographical ones. In considering the geography of a country, it seems that the geological, meteorological, and anthropo-geographical phenomena form an incidental conglomerate, having no natural tie or relation to one another, while, for instance, the evolutionist's subject of study forms a natural unity. We may be allowed to say that the naturalist demands an objective connection between the phenomena he studies, which the geographical phenomena seem to lack. Their connection seems to be subjective, originating in the mind of the observer.

Accordingly there are two principal questions which must be answered: first, the one referring to the opposition between physicists and cosmog-

raphers, i.e., Is the study of phenomena for their own sake equal in value to the deduction of laws? second, Is the study of a series of phenomena having a merely subjective connection equal in value to researches on the history of those forming an objective unity?

We shall first treat on the difference of opinion between physicists and cosmographers. The two parties are strongly opposed to each other; and it is a hard task to value justly the arguments of opponents whose method of thinking and way of feeling are entirely opposed to one's own. An unbiassed judgment cannot be formed without severe mental struggles which destroy convictions that were considered immovable, and had become dear to us. But those struggles lead to the grander conviction that both parties, though in a permanent state of conflict, aspire to the same end, — to find the eternal truth.

The origin of every science we find in two different desires of the human mind, — its aesthetic wants, and the feelings, which are the sources of the two branches of science. It was an early desire of developing mankind to arrange systematically the phenomena seen by the observer in overwhelming number, and thus to put the confused impressions in order. This desire must be considered an emanation of the aesthetical disposition, which is offended by confusion and want of clearness. When occupied in satisfying this desire, the regularity of the processes and phenomena would attain a far greater importance than the single phenomenon, which is only considered important as being a specimen of the class to which it belongs. The clearer all the phenomena are arranged, the better will the aesthetic desire be satisfied, and, for that reason, the most general laws and ideas are considered the most valuable results of science.

From this point of view, the philosophical ideas of Epicurus are very interesting, as they may be considered the extreme opinion to which this aesthetical desire can lead if the pleasure one enjoys in arranging phenomena in a clear system is the only incentive. He considered any explanation of a phenomenon sufficient, provided it be natural. It does not matter, he taught, if an hypothesis is true, but all probable explanations are of the same value, and the choice between them is quite insignificant. We believe this opinion is called to a new life by a number of modern scientists, i.e., by those who try to construct the evolution of organisms in details which, at the present time at least, can neither be proved nor refuted. If, for instance, Müller describes the history of the evolution of flowers, he gives only a probable way of development, without any better proof than that it seems to be the simplest and therefore the most probable. But this construction of a probable hypothesis as to the origin of these phenomena gives a satisfaction to our aesthetical desire to bring the confusion of forms and species into a system. But it should be borne in mind that a theory must be true, and that its truth is the standard by which its value is measured. Therefore naturalists are always engaged in examining the truth of their theories by applying them to new phenomena, and in these researches those phenomena are the most important which seem to be opposed to the theories. As soon as the question whether the theory is applicable to the class of phenomena is solved, the whole class is of little further interest to the investigator.

While physical science arises from the logical and aesthetical demands of the human mind, cosmography has its source in the personal feeling of man towards the world, towards the phenomena surrounding him. We may call this an 'affective' impulse, in contrast to the aesthetic impulse. Goethe has expressed this idea with admirable clearness: "It seems to me that every phenomenon, every fact, itself is the really interesting object. Whoever explains it, or connects it with other events, usually only amuses himself or makes sport of us, as, for instance, the naturalist or historian. But a single action or event is interesting, not because it is explainable, but because it is true" (*Unterhaltungen deutscher Ausgewanderten*).

The mere occurrence of an event claims the full attention of our mind, because we are affected by it, and it is studied without any regard to its place in a system. This continuous impulse is the important counterbalance against the one-sidedness of a science arisen from merely aesthetic impulses. As the truth of every phenomenon causes us to study it, a true history of its evolution alone can satisfy the investigator's mind, and it is for this reason that Epicurus's probable or possible explanation is not at all satisfactory for science, but that every approach to truth is considered a progress by far superior to the most elaborate system which may give proof of a subtile mind and scrupulous thought, but claims to be only one among many possible systems.

Naturalists will not deny the importance of every phenomenon, but do not consider it worthy of study for its own sake. It is only a proof or a refutation of their laws, systems, and hypotheses (as they are deduced from true phenomena), which they feel obliged to bring as near the truth as possible. The deductions, however, are their main interest; and the reward of the indefatigable student is to review, from the summit of his most general deductions, the vast field of phenomena.

Joyfully he sees that every process and every phenomenon which seem to the stranger an irregular and incomprehensible conglomerate is a link of a long chain. Losing sight of the single facts, he sees only the beautiful order of the world.

The cosmographer, on the other hand, holds to the phenomenon which is the object of his study, may it occupy a high or a low rank in the system of physical sciences, and lovingly tries to penetrate into its secrets until every feature is plain and clear. This occupation with the object of his affection affords him a delight not inferior to that which the physicist enjoys in his systematical arrangement of the world.

Our inquiry leads us to the conclusion that it is in vain to search for an answer to the question, Which of the two methods is of a higher value? as each originates in a different desire of the human mind. An answer can only be subjective, being a confession of the answerer as to which is dearer to him, — his personal feeling towards the phenomena surrounding him, or his inclination for abstractions; whether he prefers to recognize the individuality in the totality, or the totality in the individuality.

Let us now turn to the discussion of the second point. We have seen that physicists are inclined to acknowledge the value of a certain class of cosmographical studies. It is the characteristic quality of those phenomena that they are the result of the action of incidental causes upon one group of forces, or upon the elements of phenomena. The physicist does not study the whole phenomenon as it represents itself to the human mind, but resolves it into its elements, which he investigates separately. The investigation of the history of these elements of phenomena leads to a systematical arrangement, which gives to the aesthetical desire as much satisfaction as the formulation of laws. The end which evolutional and astronomical researches tend to is the best proof of this fact. A study of groups of phenomena, which seem to be connected only in the mind of the observer, and admit of being resolved into their elements, cannot lead to a similar result, and is therefore considered of inferior value. However, we have tried to prove that the source of cosmographical researches is an affective one. If this be right, we cannot distinguish between complex and simple phenomena, as the physicist tries to do, and neglect their subjective unity, — the connection in which they appear to the mind of the observer. The whole phenomenon, and not its elements, is the object of the cosmographer's study. Thus the physiognomy of a country is of no interest to the physicist, while it is important to the cosmographer.

From the stand-point we occupy, a discussion as to the value of these researches is of just as little avail as that on the value of the two branches of science, for the judgment will be founded on the mental disposition of the judge, and be only a confession as to which impulse predominates, the aesthetic or the affective. However, one fact appears from our inquiry: cosmography is closely related to the arts, as the way in which the mind is affected by phenomena forms an important branch of the study. It therefore requires a different treatment from that of the physical sciences.

We will apply these results to the study of geography. Its objects are, the phenomena caused by the distribution of land and water, by the vertical forms of the earth's surface, and by the mutual influence of the earth and its inhabitants upon each other.

What does the physicist do with this object of study? He selects a single element out of phenomena which are observed at a certain point of the earth's surface, and compares it with another one found at another place. He continues in this way searching for similar phenomena, and loses sight altogether of the spot from which he started. Thus he becomes the founder of the sciences into which geography has gradually been resolved, as his studies are either directed to geological phenomena alone, or to meteorological, botanical, or whatever it may be. The most general deductions which can be reached in the pursuit of these studies still have a close connection with the single object, as they cannot be carried farther than to the most general geographical ideas, as mountain-ranges, running water, oceans, etc. The most general results of his investigations will therefore be a general history of the earth's surface. If he bring these results into a system, he acts, as it seems to us, against the cosmographical character of the science. For instance, a system of all possible actions of water as forming the earth's surface seems to us of little value, except from a practical stand-point as being useful in studying the geological history of a district or of the earth's surface. Therefore these systems must be considered as important auxiliary sciences, but they are not geography itself. Their value is founded only on their applicability to the study of geography. The invention of geographical systems, so far as they do not serve this purpose, must be considered as useless, and classifications must be made only as far as geographical phenomena of a similar kind must be explained by different causes.

But there is another branch of geography besides this, equal to it in value, — the physiognomy of the earth. It cannot afford a satisfactory ob-

ject of study to the physicist, as its unity is a merely subjective one; and the geographer, in treating these subjects, approaches the domain of art, as the results of his study principally affect the feeling, and therefore must be described in an artistic way in order to satisfy the feeling in which it originated.

Our consideration leads us to the conclusion that geography is part of cosmography, and has its source in the affective impulse, in the desire to understand the phenomena and history of a country or of the whole earth, the home of mankind. It depends upon the inclination of the scientist towards physical or cosmographical method, whether he studies the history of the whole earth, or whether he prefers to learn that of a single country. From our point of view, the discussion whether geology or meteorology belongs to geography is of little importance, and we are willing to call all scientists geographers who study the phenomena of the earth's surface. We give geology no preference over the other branches of science, as many modern scientists are inclined to do. The study of the earth's surface implies geological researches as well as meteorological, ethnological, and others, as none of them cover the scope of geography, to delineate the picture of the earth's surface.

Many are the sciences that must help to reach this end; many are the studies and researches that must be pursued to add new figures to the incomplete picture; but every step that brings us nearer the end gives ampler satisfaction to the impulse which induces us to devote our time and work to this study, gratifying the love for the country we inhabit, and the nature that surrounds us.

FRANZ BOAS.

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## *ITALIAN MEDICAL PSYCHOLOGY.*

THE study of the nervous system in health and disease has been assiduously cultivated in Italy for many years. The peculiar environment and volatile characteristics of the race may have been influential in drawing attention to the study of insanity.

Italian alienists have taken a deep interest in the psychological aspects of their specialty; and their main review, the *Rivista sperimentale di freniatria*, has been thriving for many years. A brief notice of a few of the articles contained in the last volume will serve to indicate some of the directions in which work is being carried on.

A frequent contributor to this review was the physiologist Buccola, who died last year. He has published a volume in the International scientific series which is devoted to an account of the experimental study of the time of psychic processes, and which merits an English translation. One of his latest researches is embodied in a long article in this review on the electric reaction of the acoustic nerve in the insane. If you place one of the poles in the external auditory chamber, and the other on the neck or the hand, besides causing slight pain, muscular contractions, etc., a distinct sound will be heard on closing the circuit if the negative pole is in contact with the ear, and on opening the circuit if it is the positive pole. This for the healthy ear. But in the insane this formula is sometimes reversed, and suffers irregularities. The examination of the auditory apparatus is thus of diagnostic value, especially in cases of auditory hallucinations. In almost all such cases the hearing is thus shown to be diseased, and in a few cases stimulation of the auditory nerve caused the hallucinations to appear.

Two observers, Tambroni and Algeri, contribute to this study of the psychic diagnosis of insanity an account of experiments upon the reaction times of the insane. After some preliminary training, the patient was subjected to eight tests of forty observations each. An observation consisted, 1°, in measuring the time necessary for the patient to feel the contact of a point; 2°, the time to perceive whether a single point or a pair of points 2.2mm. apart was drawn across the tip of his right forefinger. The paranoic patient reacts more quickly than the normal man; and in this is implied not only that he feels sooner, but knows what he feels more rapidly: it is a psychic hyperaesthesia. In all other forms of insanity the time of a simple reaction and of a distinction is lengthened when the normal time is .183 of a second; the time of the paranoic type is .174 of a second; of the maniacal, .312; of the demented, .344; of the epileptic, .362; of the melancholic (in whom all mental life is sluggish and monotonous), .374. Four persons of each type were examined. It takes slightly longer to perceive a double than a single point.

A very careful study on the effect of repetition of simple acts, that is, of practice, upon the time it takes to perform them, is rendered by Guicciardi and Cionini. They take as their basis three well-known laws regarding practice; viz., 1°, that it makes repetition easier (and quicker); 2°, that it does so at first more rapidly than later on; and, 3°, that a limit to this process is slowly reached. The original part of their work consists in showing that practice has greater abbreviating power in complicated than in simple acts. A simple touch reaction by the effect of 250 repetitions was shortened .018 of a second; the time for perceiving that but a single point was touching

the skin, by .121 of a second; that two points were touching, by .194 of a second. The time necessary for uniting three letters was shortened by 1.956 seconds in 500 repetitions. In associating abstract words, there was a difference of nearly five seconds between the longest and the shortest time.[1]

## *MINERAL PHYSIOLOGY AND PHYSIOGRAPHY.*

THIS book is a collection of essays which their author has published during the past few years in the proceedings of several learned societies, especially in the Transactions of the Royal society of Canada. The preface states that they were all written with a predetermined plan, which their presentation in this connected form for the first time fully realizes. The work will furnish a valuable addition to every geological library. There is apparent in it an astonishing amount of learning and painstaking research, in spite of the fact that the views of others are not infrequently presented in a partial or one-sided manner; the author's conclusions also are well worthy of study, although many of them will hardly be received by geologists as final.

It would be impossible, in a brief review, to do justice to a single one of the essays, to say nothing of the collection of them before us. The first two serve as a general introduction and attempt to show the relations of the natural sciences to each other and to geology. Then are considered in succession the chemistry of the earth's atmosphere; the origin and decay of the crystalline rocks; a natural system in mineralogy; a history of pre-Cambrian rocks and serpentines; and, finally, the Taconic question.

The most interesting and novel portion of the work is contained in chapters v. and vi., which set forth the author's remarkable views regarding the origin of the crystalline schists. These, as he states, are purely Neptunic or Wernerian. The former hypotheses relating to the Archean rocks are reviewed and classified as, 1°, endoplutonic; 2°, exoplutonic; 3°, metamorphic; 4°, metasomatic; 5°, chaotic; 6°, thermochaotic. None of these are regarded as satisfactory; and a seventh, so-called 'crenitic' theory is therefore advanced. According to this, the globe has solidified regularly from its centre outward, its last layer being a basic, quartzless rock, not unlike dolerite in composition. This mass was fissured and rendered porous by 'refrigeration and crystallization' (!) and upon it were precipitated the waters, till then held in the atmosphere. These were set in circulation by the heat from below, and under high temperature and pressure they leached out the more acid, alkaline silicates from the basic substratum below, and deposited them in thick layers at the surface, like the products of thermal springs (hence the term 'crenitic,' from κρήνη, 'a fountain'). The chemistry of this process is supposed to resemble that whereby quartz, orthoclase, and the zeolitic minerals are occasionally deposited in cavities of basic eruptive rocks. By such crenitic action, in the author's opinion, all the banded, pre-Cambrian rocks were formed. These were, moreover, of such a thickness as to bury the original basic substratum too deeply for any subsequent upheavals to expose it at the earth's surface. The crenitic hypothesis is also supposed to offer "for the first time a reasonable and tenable explanation of the universal corrugation of the oldest crystalline strata," in the removal of such a large quantity of matter from the underlying basic layer. Through these crumpled crenitic rocks (Archean granites, gneisses, and schists) came intrusions of a basic magma derived from the underlying or original stratum, while the upper or transition pre-Cambrian rocks, as the author calls them with Werner, are regarded as derived from the subaerial decay of the two types of primary origin.

The objections which at once suggest themselves to this remarkable theory of the origin of the crystalline rocks are far too many to be even mentioned here. The leaching-out of a layer, 'at least many miles in thickness,' of quartz and potash-felspar, from a basic substratum, requires sufficient draughts on the imagination; while, even in case this be assumed as possible, it is still more difficult to conceive how the waters could circulate through this compact overlying layer which they were depositing, with sufficient freedom to increase it to anywhere near the thickness which the hypothesis requires.

No one will deny that any single *one* of the numerous theories hitherto proposed, fails to satisfactorily account for all the phenomena exhibited by the so-called crystalline rocks; nor is it at all probable that any theory ever will accomplish this. There is doubtless some element of truth in all the theories, and the only way to explain the diversity of Archean geology would seem to be by the assumption of an equal diversity in the causes which produced it. The dogma that many different agencies may not have acted at the same time in the formation of the pre-Cambrian rocks, is as dangerous as the other, that the same agency may

[1] It is not quite clear whether these differences refer to the extreme limits of a single experiment, or to the extreme differences of the average of each set of fifty observations.

*Mineral physiology and physiography.* By T. STERRY HUNT. Boston, Cassino. 8°.

not have acted at different times, — one that carries with it the fallacious conclusion that the lithological character of a rock is any reliable indication of its geological age.

Chapter viii., entitled 'A natural system in mineralogy,' suggests a new basis of mineralogical classification, and illustrates it in a new classification of the silicates. These are divided into three main groups, according as their bases are in the protoxide state (protosilicates), in both the protoxide and sesquioxide states (protopersilicates), or wholly in the sesquioxide state (persilicates). These groups are further divided into various tribes according to principles which cannot be explained in this place. Whatever may be the chemical merits of this system, it would appear to do serious violence to the crystallographic relationships of certain minerals, as may be seen in the wide separation of the members of the pyroxene and amphibole groups.

The three remaining essays are of an historical character, and contain a vast amount of information regarding the views which have been held on the subject of crystalline rocks. The first of these is a summary of the writer's report E of the Second geological survey of Pennsylvania, on the pre-Cambrian rocks in America and Europe. The second deals with the geological history of the serpentines, and develops the writer's idea that all serpentines are of aqueous origin, being of the nature of chemical precipitates. The chemical origin of a small and long-since buried bed of a serpentine-like deposit occurring in the Onondaga salt-group at Syracuse, N.Y., and of the magnesian silicates (sepiolites) of the Paris basin, together with certain reactions which are found to take place between the carbonates of lime and magnesia and free silica in heated solutions, are adduced as a proof that *all* serpentine is of chemical origin. There seems here to be a very partial and one-sided statement of the best authorities on this subject, for the origin of serpentine by the hydration of eruptive chrysolitic rocks will surely be disputed to-day by no one who has carefully and impartially looked into the matter. Though there may be truth in both hypotheses, there is more evidence in favor of the latter; so that here, again, the danger of accounting for all rocks of similar character by one set of causes becomes apparent.

The final essay is devoted to an elaborate review of the Taconic question and a statement of the writer's opinion that the Taconic of Emmons is a formation of the transition class, which unconformably underlies the Cambrian, and is separated from it by a great interval of time which includes the Keweenian period.

Throughout, the book is interesting, — almost fascinating, — but nevertheless full of danger to any one who accepts it implicitly as a guide, or to the beginner who is not able to estimate it in comparison with the work of others.

## REMSEN'S ELEMENTS OF CHEMISTRY.

IN the preface to his 'Elements of chemistry,' Professor Remsen states his opinion, that if a course in chemistry "does not to some extent help the pupil to think as well as to see, to reason as well as to observe, it does not deserve to be called rational." An essential part of his plan in this elementary course is the performance of experiments by the pupil, who is then to be questioned by the teacher concerning the results of the experiments, and the conclusions to be drawn from them. Appropriate questions are given in the book in connection with the description of each experiment, and a quite extensive list of questions and problems (not numerical) is appended at the end of the work. A number of experiments, with questions, illustrative of chemical change in general, are given at the outset, before even the names of the elements, or the distinction between elements and compounds, is imparted. The atomic theory and that of valence are treated briefly and clearly, special care being taken to prevent the too common confusion of facts and hypotheses in the young student's mind. A great deal of attention is devoted to subjects which are likely to interest the pupil by reason of their practical importance or their relation to his daily life. Such are the manufacture of soap and paper, fermentation, bread-making, the working of iron, and the impurities of water. In these as well as in other subjects the endeavor seems to have been made to introduce all of the most recent discoveries and advances which are suitable to an elementary treatise. Examples are the water-gas process, the liquefaction of the 'permanent' gases, the electrical furnace, celluloid, cocaine, and artificial alizarin.

About one-ninth of the volume is devoted to a description of some of the compounds of carbon. The relations between the principal classes of these bodies are pointed out, but no attempt is made to teach the structural formulae of the more complex compounds.

THE U.S. consul at Palermo, Mr. Philip Carroll, has forwarded to the state department a translation of a pamphlet issued by Prof. E. Albanese, president of the sanitary council of

*The elements of chemistry.* By IRA REMSEN. New York, Holt. 12°.

Palermo. In this pamphlet he says that typhoid and scarlet fevers, diphtheria, small-pox, and cholera seem to have made their abode in Italy. The country remains unprovided with sanitary laws; and the government, lacking etiological and hygienic knowledge, makes provision only when any disease appears, and nearly always in consonance with the impression of the moment, issuing confusing or conflicting decrees and unreasonable instructions, which are nearly always useless. Then the cholera has its sway, and cities are terror-stricken. The sanitary authorities of the kingdom, the superior sanitary council, the minister of the interior, prefects and mayors, frequently provide contradictory measures, issuing regulations of no efficacy in preventing the spread of infectious diseases. During the last twenty-six years, in which Italy has been free, the government has never occupied itself with public health. In Sicily, Napoletano, Puglie, and Abruzzo, animals dwell in the same rooms with the people who own them. The pamphlet of Professor Albanese clearly demonstrates that sanitary matters in Italy are about as bad as they can be, and that, unless remedies are soon applied, there is nothing in the list of epidemic diseases which may not be looked for in the near future. He recommends that the government should at once assemble a commission composed of the most eminent hygienists and practical physicians, with a view to projecting a re-organization of sanitary systems.

— No. v. of part iv. of the eleventh volume of the 'Memoirs of the American academy of arts and sciences' contains the first instalment of a 'catalogue of 130 polar stars for the epoch 1875.0.' The joint authors are Prof. William A. Rogers and Miss Anna Winlock; and to the latter the credit of the execution of the work, according to Professor Rogers's plans, is due. The computations involved are very laborious, and one must admire the zeal and patience with which Miss Winlock has carried them through. The catalogue is based upon all observations of the stars from 1860 to 1885, and therefore a large number of reductions to the epoch 1875.0 had to be performed. For polar stars these reductions are quite tedious, because terms of higher orders cannot be neglected. It was therefore decided to discuss the various methods of reduction, and to find out the limitations of the approximations employed. The star Groombridge 1119 was chosen for this purpose, it being one degree from the pole, and the computations are given *in extenso*. The conclusions reached as to the availability of the different methods cannot be explained here, but are of much interest to astronomers. The authors have made a really valuable contribution to the literature of the subject. Among other things, the catalogue, when completed, will contain yearly ephemerides of all of its stars within three degrees of the pole, and data for the reduction of the different catalogues employed to the system of the *Astronomische Gesellschaft*.

— Dr Lombard has re-investigated the question as to whether or not the upward movement of the leg, when the patellar tendon under the knee is struck, is a reflex act. The main argument against its being so is that the act requires only .03 to .04 of a second, while the reflex act requires .11. The chief point in favor of its reflex origin is that the vigor of the reaction depends on the integrity and health of the spinal cord. The explanation that the phenomenon is direct muscle-effect, but that the spinal cord must send down a shower of reflexes or keep up a healthy tonus to have the act result, is very unsatisfactory. Dr. Lombard found that the act follows after the same interval, when the muscle is electrically stimulated or the tendon struck, but that the interval is much longer (four times as long) when a reflex contraction is excited by rubbing the skin. Hence it is argued that the phenomenon is a direct muscular stimulation, and occurs too quickly to be of a reflex nature. In one case an after-jerk, following at an interval that suggested a reflex origin, was recorded; but this compound nature of the response, though carefully looked for, was not again observed. The explanation of the relation of the knee-jerk to the spinal cord cannot yet be given.

— George Fleming, LL.D., principal veterinary surgeon of the British army, regards as untrue the generally accepted theory that small-pox in man, and cow-pox, are one and the same disease. One of the best authorities quoted in support of the theory was the late Mr. Ceely, who reported that he had succeeded in producing cow-pox by inoculating a cow with small-pox matter. Dr. Fleming believes that Mr. Ceely was misled in this experiment, and that what he really used was vaccine, and not the virus of small-pox. His experiment was subsequently repeated on twelve heifers by Dr. Klein under Mr. Ceely's supervision, and, though small-pox matter was inserted abundantly into the incisions, cow-pox was not developed in any of the animals. Similar experiments have been performed in France and Italy, and the results have all been the same as those in England. Dr. Fleming holds that all these experiments go to show that the two diseases are not identical, nor can cow-pox be produced by inoculation with small-pox virus.

FRIDAY, FEBRUARY 18, 1887.

# SCIENCE.

## *COMMENT AND CRITICISM.*

BY THOSE WHO READ aright the signs of the times, it is seen that important advances in education are destined to be made in the not very distant future. And those advances are not to be, as some have been in the past, wholly or partly destructive. For a true philosophy of progress, a destructive advance does not exist. The present is rooted in the past, and the future will draw its nourishment from the present. Any change or development is conditioned by that which is changed and developed. We cannot destroy present conditions if we will. We may alter, amend, or counteract them, but their annihilation is possible neither in thought nor fact. Therefore it is that those educational reformers who would sweep away all that now exists, before they begin their work of construction, are harmful agitators. They raise a demand that they cannot supply. They waste time, and thought, and money. The true educational progress is going to be more scientific, more philosophic, than this. It will take things as it finds them, and mould them to its purpose. It is no sign of sound educational thinking to join the senseless clamor for the sweeping-away of Greek, or philosophy, or every thing else that cannot be at once coined into dollars and cents. Utility is never going to be the test of the true education. The true progress will suffer no such lowering of its ideal. It will keep before it, as its aim, the development of man, and the whole man, as man. But it will ask whether we have not overlooked some of man's faculties. It will inquire with what reason we have in the past instituted a feudal system among the human powers, which relegates some of them to an undignified servitude, and gives to others all the honor and esteem. Have we not overstepped the limits of science in this respect?

Locke called the senses the 'windows of the soul,' but we have, to a great extent, closed or defaced those windows, without reflecting that by so doing we were denying to the soul some of its possibilities of development. Some senses we have neglected entirely, others we have educated only in part. The eye is taught to read, and the hand to write, but neither is taught to draw, or to mould and fashion. Many of the refinements of the sense of touch are also entirely passed over. To remedy these, and similar omissions in our education, not destruction but construction is necessary. Keep what we have that is good, but rearrange it, that the elements hitherto neglected may find a place in the scheme. The education that will do this, is the new education, but it is sadly in need of a name. Words merely stand for ideas, to be sure, but sometimes a word adds to the definiteness of the idea it represents. 'Manual training' will not do, for that conveys the idea of teaching a trade. The new education will not do this. 'Industrial education' will not do, though a meaning, not explicitly conveyed by the words, may be read into the phrase. Yet this means ambiguity, and ambiguity means loss of force and directness. A name is wanted, but it must, to be satisfactory, stand for the idea we have outlined. It must not mean the training of the hand and eye alone, but the training of the mind through the hand and eye. And it must not exclude the older instruction, which is excellent as far as it goes, but which does not go far enough. It is this — the old plus the new — which we mean by the new education.

No. 211 — 1887.

THE RECENT ARTICLE in the *Contemporary review* on university education in the United States, by President Charles Kendall Adams of Cornell, is a very clear and succinct account of the progress of thought on university subjects in this country during the past half century. It should be particularly welcome to those European students of educational science who desire to understand the development of educational thought in this country. President Adams shows very clearly that the establishment of our scientific and technical schools, the founding of parallel courses, as at Cornell and Michigan universities, and the building-up of the elective system, as at Harvard, were all the outcome of the same desire, — to satisfy the increasingly critical demands as to higher education. President Adams sustains President

Eliot in all the latter's recent controversies respecting his favorite elective system, and seems to show himself quite as favorably disposed toward the elective system, pure and simple, as toward the scheme of parallel courses, to the development of which he has hitherto given so much thought. The article will shed a flood of light upon the educational discussions in this country as they appear to foreign readers, and it will set some facts even more clearly before our own countrymen.

WHAT TEACHERS SHOULD READ, is an interesting question, and one about which there is more or less misconception. Some persons seem to think, that, because teachers are teachers, they cease to be men and women. At least this is the inference which we feel justified in drawing from much that is written and said on this subject. Lists of books that it is desirable that teachers should read, are drawn up, but in nine cases out of ten they contain none but professional works. This is undesirable, for a variety of reasons. In the first place, it narrows the teacher's view, confines his sympathies, and aids in the development of notions and methods best denominated as 'cranky.' Then, too, pedagogic literature is not a thing to be indiscriminately recommended to teachers. It needs severe critical revision, before all the harmful and time-wasting elements in it are eliminated. Rosenkranz points out, in his 'Philosophy of education,' that the treatises on education abound more in shallowness than any other literature. Short-sightedness and arrogance, he says, find in educational literature a most congenial atmosphere, and uncritical methods and declamatory bombast flourish there as nowhere else. All this must be recognized and guarded against; and from what we see of current educational literature, periodical and otherwise, it is not yet recognized and guarded against sufficiently. An inconceivable amount of nonsense is talked and written about education. Dr. William T. Harris, in a recent note on this subject of reading for teachers, very sensibly urges a course of reading for teachers that will secure general culture, and furnish new inspiration in the task of instruction. Dr. Harris mentions a number of books as suitable for this purpose, and, though neither complete nor satisfactory, it serves well enough to emphasize the fact that teachers retain their humanity, and by how much the more they cultivate and broaden it, by so much do they increase the value and efficiency of their teaching-powers.

DR. WITHERS-MOORE'S ADDRESS on the subject of the higher education of women, delivered before the British medical association, has raised a great storm of indignation among the advocates of women's higher education, both in England and in this country. We have, from time to time, called attention to various phases of the argument as it has proceeded. Mrs. William Grey, in a paper read recently before the ladies' council of education, at Leeds, is the last participant in the controversy. She passes by Dr. Withers-Moore's argument, with the remark that no time need be wasted in 'flogging a dead horse,' and criticises at some length the statement of Dr. B. Ward Richardson, that, "there is nothing in women's constitution, physical, moral, or mental, to prevent their competing successfully with men in any field of labor whatsoever, *provided they will pay the price for it.*" This price Dr. Richardson had asserted to be the loss of grace and beauty, and the renunciation of all the joys of home and family, especially motherhood. Mrs. Grey admits that marriage so severely handicaps a woman that there is little if any chance of her reaching the top of the professional tree. She claims, however, that Dr. Richardson's arguments, in common with those of nearly all writers and speakers opposed to the 'claims of women,' are vitiated by the fact that they apply, not to women as a sex, but only to that small minority whose circumstances permit them to choose between work and idleness, — "between going into the battle of life, or sitting at home at ease, while it is fought for them by others."

This minority is so small that Mrs. Grey prefers to regard it as constituting the exceptions to the universal rule that women, as a sex, take, if anything, more than their fair share in the hard work of the world, while fulfilling at the same time their special function of motherhood. She quotes some instances from her experiences in Italy, and becomes indignant at the idea that the strain upon a woman's physical powers unfits her for her peculiar functions as a mother. "The hollowness of the talk about woman's work, and what they have or have not strength for," says Mrs. Grey, "is made manifest the moment we look outside drawing-rooms to the real facts of woman's life as a whole." It might be suggested, in reply to this argument, that it is precisely this class of women, whom Mrs. Grey treats as exceptions to the general rule, that the higher education

reaches. It certainly cannot reach women as a sex any more than it now reaches men as a sex. It may be that the classes of women, the majority who work hard and the minority who lead a life of relative ease, have become so far distinct that the same argument will not apply to both. If so, considerations drawn from the study of the class which the higher education is not expected to reach, become no longer pertinent when applied to the class of women who will, if any, receive the benefits of the proposed training. There is, unquestionably, much hasty and impulsive expression of opinion on this important question, but may it not also be true that there is some loose thinking concerning it?

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THE ELEVENTH ANNUAL REPORT of President Gilman to the trustees of the Johns Hopkins university is largely a retrospect of what the university has accomplished during the decade of its existence. Much that the president says, he has told us before, or it has been embodied in the university publications. The aim of the collegiate instruction is defined to be, "the training of the mind and character to habits of fidelity, attention, perserverance, memory, and judgment," and in pursuance of that aim, the well-known group system has been put in operation, so as "to secure a positive amount of regulation with a certain amount of freedom." During the decade, fellowships have been bestowed upon one hundred and thirty-four individuals, and to this fellowship system President Gilman ascribes — and with reason — much of the success of the university. By far the major number of these fellowships have been bestowed upon students of science, — biology, chemistry, mathematics, physics, geology, and engineering having had seventy-eight fellows, while all the languages, together with historical science and philosophy, have had but fifty-six allotted to them. In apparatus, library, and publications, the university is well supplied, though much remains to be done in all these directions. President Gilman also has something to say regarding the effect of scientific advance on the moral and spiritual nature of man. He expresses the conviction that "man's consciousness of his own personality, with its freedom and responsibility, his belief in a Father Almighty, his hopes of a life to come, his recognition of a moral law and of the authority of an inward monitor, will stand firm, whatever discoveries may be made of the evolution of life, the relation of soul and body, the nature of atoms and of force, and the conceptions of space and time. Science shows us that all knowledge proceeds from faith, — the assumption of premises in which the investigator believes."

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An interesting feature of the report is the selection made by President Gilman from papers submitted to him by the several heads of departments, summarizing the work performed by each, and the theory on which the department has been organized. Of the classical instruction, Professor Gildersleeve writes: "In organizing the classical department, the importance of both sides, the scientific and the literary, was carefully considered. Without scientific study, the cultivation of the literary sense is apt to degenerate into finical aestheticism; kept apart from the large and liberal appreciation of antique life in all its aspects, the scientific study of the classic languages divorces itself from sympathy with tradition, and relinquishes its surest hold on the world of culture, on which the structure of the university must rest. . . . All university students should work in common. The leader should assign no work that is without its lesson to the most experienced student, or without its stimulus to the merest novice. . . . The history of the last ten years shows that the steadfast adherence to these lines of work has won for the university an influence that manifests itself far beyond the domain which it now occupies, and which it has been persistently extending." The work in history and political science is adapted to the needs of three classes of students, the undergraduates, the undergraduates who want to give special attention to historical studies, and the graduate students. Professor Remsen's idea has been, that it is better "to train thoroughly a small number of chemists than to make a large number of mere analysts," And in a similar way other professors outline their scheme of work. Thus, President Gilman has brought together, not merely data of interest to the friends of Johns Hopkins university, but expressions of opinion from eminent men as to how higher instruction in their several specialties can best be organized.

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SOME EDUCATIONAL JOURNALS, in taking notice, as we did, of the action of the authorities of a state teachers' association in mitigating the text-book and school-journal peddling nuisance at a recent meeting, are disposed to blame the authorities for

having taken an unjustifiable step. We are disposed to believe that these papers must have been among those whose activity was curtailed at the meeting in question. One of them, for example, naïvely inquires whether it is "a worse crime to exhibit and explain a book at an educational gathering than to show the use of a plow at an agricultural fair." We would point out that this analogy is fallacious. The end and aim of an agricultural fair is to see and examine all the new agricultural implements and products, and the demonstration of the virtues of a certain plow is precisely what the spectators have come to see. An educational gathering, on the contrary, is not called together once a year, or once in six months, to examine and compare books and papers, but to study and discuss, under the guidance and leadership of appointed speakers, questions pertaining to the theory and practice of the teacher's profession. If an exhibit of text-books and school-journals can be arranged so as not to interfere with the proper carrying out of the object of the meeting, let it be done. Such an exhibit can do little harm, and may do much good. But the representatives of publishing houses do not always stop here. They make themselves a good deal of a nuisance, and interfere with the work of the association. We fancy that it was this feature of the exhibit that was objected to in Massachusetts, and we heartily commend those in charge of the arrangements for the meeting, for putting a stop to it.

## *LEFT-HANDEDNESS.—A HINT FOR EDUCATORS.*

DR. DANIEL WILSON, president of the Royal society of Canada, has lately contributed a paper to the Proceedings of that society on the subject of left-handedness, to which he has managed to give an unexpected and very practical interest, affecting all who have children or who are concerned in their education. The author had written previously on this subject, but not with such full and effective treatment. He reviews the various causes to which the general preference of the right hand has been ascribed, and also those to which the occasional cases of left-handedness are attributed, and finds them mostly unsatisfactory. He shows clearly that the preferential use of the right hand is not to be ascribed entirely to early training. On the contrary, in many instances, where parents have tied up the left hand of a child to overcome the persistent preference for its use, the attempt has proved futile. He concludes that the general practice is probably due to the superior development of the left lobe of the brain, which, as is well known, is connected with the right side of the body. This view, as he shows, was originally suggested by the eminent anatomist, Professor Gratiolet. The author adopts and maintains it with much force, and adds the correlative view that "left-handedness is due to an exceptional development of the right hemisphere of the brain."

A careful review of the evidence gives strong reason for believing that what is now the cause of the preference for the right hand was originally an effect. Neither the apes nor any others of the lower animals show a similar inclination for the special use of the right limbs. It is a purely human attribute, and probably arose gradually from the use, by the earliest races of men, of the right arm in fighting, while the left arm was reserved to cover the left side of the body, where wounds, as their experience showed, were most dangerous. Those who neglected this precaution would be most likely to be killed; and hence, in the lapse of time, the natural survival would make the human race, in general, 'right-handed,' with occasional reversions, of course, by 'atavism,' to the left-handed, or, more properly, the ambi-dextrous condition. The more frequent and energetic use of the right limbs would, of course, react upon the brain, and bring about the excessive development of the left lobe, such as now generally obtains.

The conclusions from this course of reasoning are very important. Through the effect of the irregular and abnormal development which has descended to us from our bellicose ancestors, one lobe of our brains and one side of our bodies are left in a neglected and weakened condition. The evidence which Dr. Wilson produces of the injury resulting from this cause is very striking. In the majority of cases the defect, though it cannot be wholly overcome, may be in great part cured by early training, which will strengthen at once both the body and the mind. "Whenever," he writes, "the early and persistent cultivation of the full use of both hands has been accomplished, the result is greater efficiency, without any corresponding awkwardness or defect. In certain arts and professions, both hands are necessarily called into play. The skilful surgeon finds an enormous advantage in being able to transfer his instrument from one hand to the other. The dentist has to multiply instruments to make up for the lack of such acquired power. The fencer who can transfer his weapon to the left hand, places his adversary at a disadvantage. The lumberer finds it indispensable, in the opera-

tions of his woodcraft, to learn to chop timber right and left handed; and the carpenter may be frequently seen using the saw and hammer in either hand, and thereby not only resting his arm, but greatly facilitating his work. In all the fine arts the mastery of both hands is advantageous. The sculptor, the carver, the draughtsman, the engraver and cameo-cutter, each has recourse at times to the left hand for special manipulative dexterity; the pianist depends little less on the left hand than on the right; and as for the organist, with the numerous pedals and stops of the modern grand organ, a quadrumanous musician would still find reason to envy the ampler scope which a Briareus could command." That all this is true is abundantly shown by the numerous examples cited by the author, — from the greatest of artists, the left-handed Lionardo da Vinci, to the distinguished ex-president of the American scientific association, Prof. Edward F. Morse, and (we may add) to Dr. Wilson himself, both of whom are known to be accomplished draughtsmen with this too-neglected hand. In view of these facts, it is evident that few more important subjects can be offered for the consideration of educators than that which is presented in this impressive essay.

## *THE HUPA INDIANS: AN ETHNOGRAPHIC SKETCH.*

ONE who has charge of a museum is frequently told, "I should be delighted to help you if I only knew what you want." In the former articles of this illustrated series special arts have been elaborated in order to explain the completeness desired in anthropotechnic collections. The present paper appeals to the traveller, the missionary, the army or navy officer or private, and shows what any one of them may do at his leisure.

Since his expedition to Point Barrow, Lieutenant Ray, U.S.A., has been stationed at Fort Gaston, in north-west California, on the lower Trinity River. Here is the Hupa reservation, and here dwell what are called the Hupa Indians, — bands known by various names, but nearly all belonging to the Pacific coast branch of the great Athabascan stock, represented by the Kulchin and Tinné on the north, and by the Apache and Navajo on the south. Before these aborigines were terrorized by the white miners and fishermen, they were, in the language of Stephen Powers, the Romans of California. Although they have been calmed down to the normal stagnation of a government reservation, there remains a great deal of the old art and civilization among them. They are really in the neolithic age, and may tell us much about the way in which Frenchmen of the Robenhausien epoch lived.

If we commence by saying that their mountain homes are in the midst of giant redwoods, that their streams are the resorts of the salmon, that around them grow the materials for the finest textiles and clothing, the story of their daily life is blocked out.

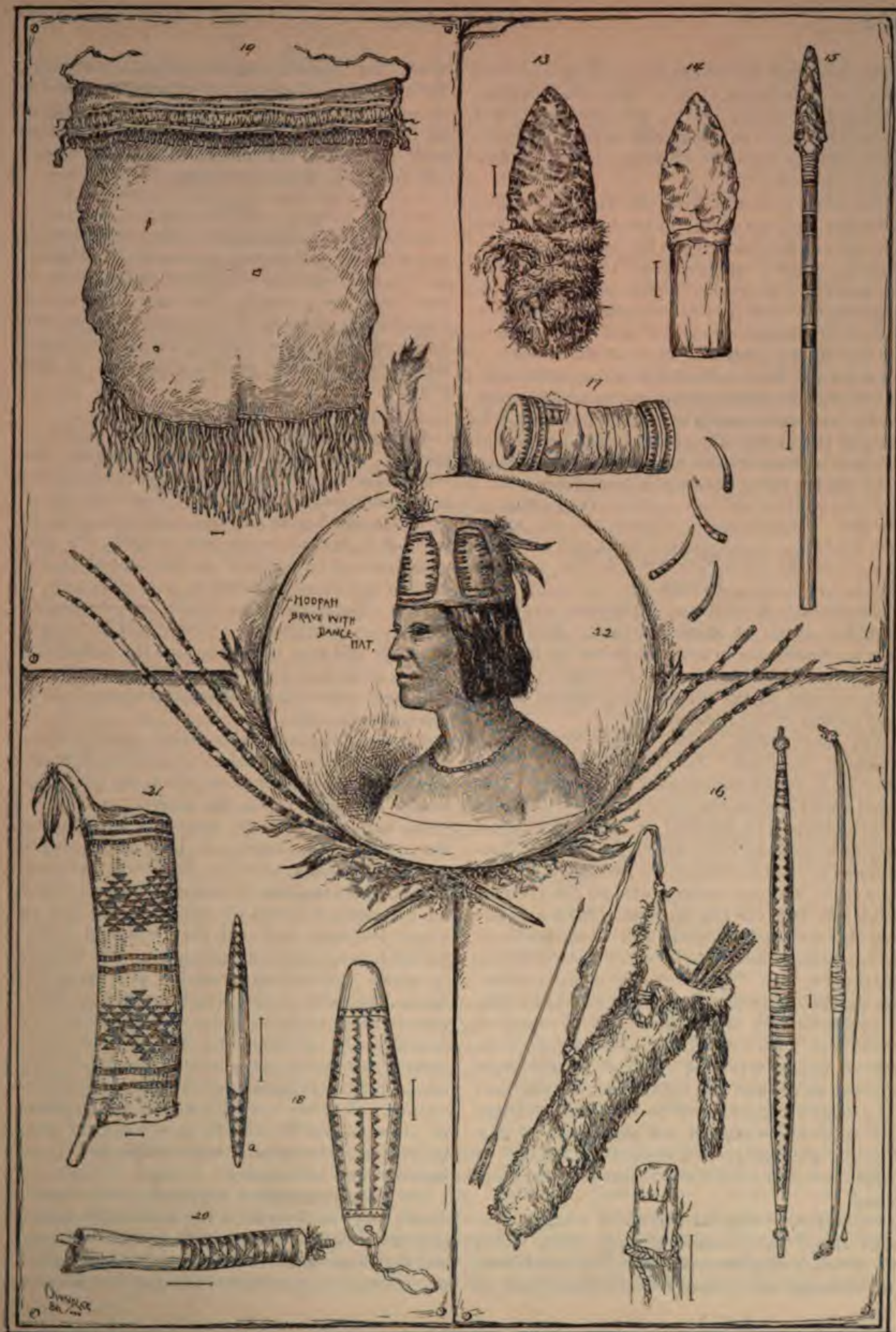
The Hupa lives in a puncheon or slab house (see accompanying plate, 1, 2), and paddles his canoe of redwood in the fish-prolific waters of the Trinity and Klamath. By means of elkhorn wedges and neatly polished, bell-shaped hammers, he is able to reduce the largest tree to any desired form of slab, which he smooths and shapes with adzes, formerly flint-bladed, now edged with steel. He also cleansed himself in a sweat-house, sat on a humble chair (4), slept like an oriental on a pillow of wood (5), and nursed his baby in the prettiest of willow cradles (3). His mush he cooked in a water-tight grass basket (6) by means of hot stones (7), baked his bread in rude soapstone pans (9), and served his roasted salmon in a wicker tray (8). Since the U. S. fish-hatching station has been planted not far off, he gently scoops around the wharf in rude citizen's dress; but formerly he made a barbed harpoon from the leg-bone of the deer (10) and rawhide, and therewith landed the wildest salmon.

Neither ancient nor modern savage could surpass him in chipping jasper and obsidian. His *lames de silex*, whether fur-wrapped (13), hafted in wood (14), or on a long pole for fishing (15), are justly the admiration of the world. His finest weapons, however, were his bows and arrows (16). The bow is of yew or cedar, and so deftly backed with a mixture of shredded deer-sinew and fish-glue that the uninitiated mistake the backing for a tough bark. His arrow consists of the following parts: shaft of willow or other soft wood; fore-shaft of hard wood, inserted in the pith of the shaft and seized with sinew; head of jasper or obsidian, untanged, and lashed with sinew; and the feather often laid on spirally. Add a pretty quiver of otter, fox, or wolverine skin, and the artillery is complete.

The Hupa women are among the most refined and delicate tanners, embroiderers, and basket-weavers in the world. A cloak of deerskin (19), fringed and decked with colored grass, or a skirt of pine-nuts, etc., is a most graceful drapery.

The Hupa has a kind of money (17) made by wrapping snake-skin or maiden-hair fern bark around long dentalium shells (17). He also cuts out disks from the clam or olive shells. The former money he keeps in a curious pocket-book of elkhorn hollowed out and wrapped with buck-


HUPA CRADLE
SPEAR HEAD.
CHANDLEE


HOOPAH
BRAVE WITH
DANCE
HAT.

skin: the latter he strings on a thong and rubs down on sandstone, like a Marquesas-islander. Feathers, however, are his greatest pride, and gaudy plumes of the woodpecker's crest, the duck's neck, and the blue-jay's plumage, are held at fabulous prices (22).

His music he draws from the whistle of bone, the rattle, and the drum; in his dances he carries a queer wand of basketry in his hand (21); sometimes he wears a 'spritsail yard' in the septum of his nose (20); he crushes vermin in his head with a spatula of elkhorn (18); and, finally, he has a fashion of putting very sharp pins of elkhorn in his hair (18*a*) to pierce the hand of the adversary.

Lieutenant Ray's collection is accompanied with an excellent descriptive catalogue, making his work for the national museum worthy of imitation. It has also the additional merit of explaining almost an equal number of nice old specimens that have been waiting forty years for an interpreter.

O. T. MASON.

## GEOGRAPHICAL NOTES.

### Europe.

The Russian government is planning an ethnographical survey of Russian Poland. This province has hitherto been much neglected by Russian scientists, and is, according to Professor Petri, not even included in the great 'Geographical statistical lexicon of the Russian empire.'

The construction of two canals in southern Russia is projected. The Duke of Leuchtenberg proposes to pierce the isthmus of Perekop. This canal would shorten the distance between Odessa and the harbors of the Gulf of Azov. The second project is far more important. The Russian government intends to connect the Don and the Volga by a canal, and the country between the rivers is being surveyed for the purpose. Thus, a waterway between the Caspian and Black seas will be established, and a new outlet opened to the produce of Asia. The project is a very old one, having been attempted by Peter the Great in 1696.

At the meeting of the Geographical society of Paris, Jan. 7, the Count of Saint-Saud gave a report on his surveys in the Pyrenees. Large tracts of these mountains are still little known, and Saint-Saud's researches will be a valuable contribution to our knowledge of the topography of that district. He discovered a mountain 9,500 feet in height, and corrected the position of some other peaks.

Feddersen, during his travels in southern Iceland, found the remains of large trees, which prove that forests formerly existed on that island. Dr. Labonne, who crossed Iceland from south to north last summer, makes a similar statement. He found some remains of willows and birches about sixteen feet below the surface, embedded in the silicious deposits of the Geyser. These facts prove the correctness of the old 'Sagas,' which refer to forests in Iceland.

### Asia.

P. Lombard, missionary in Siam, publishes, in the *Missions catholiques*, a map of the Menam, on which all settlements situated on the banks of that river are marked. The new information contained in this map is important, as Lombard has lived a long time in Siam, and has acquired a thorough knowledge of the geography of that country.

### Africa.

Junker's exploration of the Welle makes its identity with the Obangi very probable. He crossed the river six times, and followed its course as far as latitude 3° 13′ 10″, and longitude 22° 47′ 40″. He found it to run east and west, with no part of it farther north than latitude 4°. The abundance of ivory found on the islands of this river is said to surpass that of any other part of Africa. Notwithstanding these new discoveries in this part of Africa, our knowledge of its hydrography is still very imperfect, and the exploration of the watershed between the Shari and Kongo still forms one of the most important problems of researches in Africa.

Captain Coquilhat, who visited Stanley Falls after the Arabs had taken possession of it, describes the moral impression which the loss of the station has made upon the natives, as follows: "The natives admire the persistent resistance of the whites. The losses of the Arabs, which amounted to sixty, while we lost only two men, made a great impression upon the negroes. They have seen and felt that the white man is not an ally of the Arab, and that they will find a support in him against their oppression. The manner in which the natives protected and saved Mr. Deane, the chief of the station at Stanley Falls, proves that they detest the Arabs, and that they desire to be governed by whites." However, these views seem to be somewhat sanguine. The loss of Stanley Falls is a serious affair to the association, and shows how little established its power is. It would be in vain to expect support from the natives, who consider both whites and Arabs intruders in their country.

The Kongo association is planning two expeditions; one, to determine the best route for the proposed railroad; the other, to explore the Kongo and its tributaries. The latter will be composed of geologists, agriculturists, and commercial

agents. Mr. Delcommune, who spent ten years at the factories and stations on the Kongo, will probably be its leader.

The announcement of Dr. Holub's death is denied by the latest telegraphic news. Holub left Austria a few months ago, with his wife and a few servants, to explore the country north of the Zambezi, and some weeks ago news was received that a European was murdered thereabout. It seems that this report gave rise to the rumor of Holub's death.

*America.*

The Geographical society of the City of Mexico announces its intention of resuming the publication of its journal, which was discontinued in 1882.

Dr. R. Bell's report on the Alert expedition to Hudson Bay, which is contained in the last 'Annual report of the geological survey of Canada,' shows how little is known of those countries. As the object of the expedition was the relief of the meteorological stations in Hudson Strait and Bay, Bell had no opportunity of leaving the ship for any length of time. However, his observations are the only ones we have referring to this vast district, and as he has carefully availed himself of every chance the movements of the ship gave him, he offers a great deal of new material. The author, who is thoroughly acquainted with the Hudson Bay Basin, through his extensive travels and numerous researches, gives a general sketch of the distribution of strata in Hudson Bay, and makes it probable that the whole of this vast basin is composed of flat-lying paleozoic strata. His observations lead him to the conclusion that during the glacial period an enormous glacier filled Hudson Strait, and flowed east towards the Atlantic Ocean. A southern branch seems to have come from Ungava Bay. It is very desirable that a geographical expedition to Hudson Bay be organized, as the coast is only known in its general outlines, and no scientist has ever set his foot on the greater part of these districts. Since Fox's journey to Fox Channel, only a few whalers have entered this strait; and the coasts, which are within easy reach from our harbors, and are of considerable importance on account of the whale, walrus, and seal fisheries, have never been explored.

*Australasia.*

The New-Guinea company's steamer Ottilie has ascended Augusta River, in the German part of New Guinea. It was found navigable for a considerable distance. Having sailed three days, the water was found to be too shallow to continue the journey in the steamer, which drew eleven feet of water. The party ascended the river two and a half days farther in a steam launch, and returned only on account of the want of provisions. Measuring on a straight line, their farthest point was 156 nautical miles distant from the mouth of the river, and 74 miles from the north shore of the island. The existence of a navigable river of this size will be important for the development of the colony.

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## *NOTES AND NEWS.*

THE fourth annual catalogue of the Chicago manual training school is very encouraging. Although the regular school exercises were only begun in February, 1884, the total number of pupils enrolled is now 190. The course is a three years' one, and embraces instruction in mathematics, science, language, drawing, and shop-work, during the entire period. The requisites for admission are, that the candidate be at least fourteen years of age, and be able to pass a satisfactory examination in reading, spelling, writing, geography, English composition, and arithmetic. The school has a well-equipped wood-room, foundry, forge-room, and machine-shop, and ample apparatus for teaching the various subjects in which instruction is given. Under the efficient direction of Dr. Belfield, the successful future of this institution is assured.

— Perhaps no university chair in the world has had such a succession of distinguished occupants as has the Smith professorship of the French and Spanish languages and belles-lettres at Harvard. The professorship was established seventy years ago, and George Ticknor held it for nineteen years. His successor was Henry Wadsworth Longfellow, who held it for eighteen years; and James Russell Lowell, who has just resigned, held it for thirty-one years.

— In an account in *Modern language notes* for February, Mr. Calvin Thomas says that of the 176 names of those in attendance at the recent convention of the Modern language association at Baltimore, seventy per cent appeared to be English or American, and twenty per cent were obviously German. Of the total number in attendance, seventy-eight were teachers engaged in modern language work, and of this last number, sixty-five were engaged at colleges and universities. These sixty-five came from eighteen different states, as follows: from Maryland, 11; Massachusetts, 8; Pennsylvania, 8; Virginia, 6; Ohio, 4; South Carolina, 4; New Jersey, 4; New York, 3; Rhode Island, 3; Connecticut, 3; Indiana, 3; Michigan, 2; Kentucky, Louisiana, Delaware, Illinois, Tennessee, and Nebraska, each 1. These figures afford at least a rough criterion as to how far the

association has come to be truly representative of America.

— Professor Conrad of Halle has an article in the *Allgemeine zeitung* of Jan. 4, criticising the system of giving stipends to students, which now prevails at the German universities.

— *Nature* prints an account of a meeting, lately held, of the Association for promoting a teaching university for London, at which the second report of a sub-committee on the subject was received. At a meeting held in December, 1885, the committee were instructed to open communications with the governing bodies of the University of London, University college, King's college, the Royal college of physicians of London, the Royal college of surgeons of England, and the various medical schools of London, as well as with the council of legal education, for the purpose of promoting the objects of the association on the basis of that report. The committee have been informed by the senate of the University of London, and by the councils of University college and King's college, that committees of those bodies had been appointed to consider the objects and proposals of the association. The council of King's college have adopted a resolution to the effect that "the council, while reserving their opinion as to the details of the scheme laid before them by your committee, approve generally of the objects which the association has in view." The subject having been brought before the council of University college, they adopted a resolution to the following effect: "That this council do express a general approval of the objects of the association, which are as follows: 1°, the organization of university teaching in and for London, in the form of a teaching university, with faculties of arts, science, medicine, and laws; 2°, the association of university examination with university teaching, and direction of both by the same authorities; 3°, the conferring of a substantive voice in the government of the university upon those engaged in the work of university teaching and examination; 4°, existing institutions in London, of university rank, not to be abolished or ignored, but to be taken as the bases or component parts of the university, and either partially or completely incorporated, with the minimum of internal change; 5°, an alliance to be established between the university and the professional corporations, the council of legal education as representing the Inns of Court, and the Royal colleges of physicians and of surgeons of London." A conference between the deputation of the committee named in that behalf and the committee of the senate of the University of London was held on Nov. 23 at the University of London; and, at the conclusion of a long and important discussion, the vice-chancellor gave to the deputation the assurance that the general disposition of those present was to move in the direction indicated by the association. Various other institutions have virtually expressed approval of the object of the association, and, while awaiting some further communication from the senate of the University of London, which it is understood will be made, either to them, or in an independent way to the university teachers of London, the committee propose to take steps for bringing to the notice of her Majesty's government the need which exists for the co-operation of the government in order to promote university teaching in London.

— Professor Hunt of Princeton has in course of preparation a book entitled 'English prose and prose writers,' which will be published in the spring. It is intended to be a text-book for advanced instruction in English prose style.

— It is reported by the *Athenaeum* that, on the advice of Dr. W. Wright of Cambridge, and Prof. D. H. Müller of Vienna, the Oriental congress at Stockholm, and also the adjudication of the King of Sweden's two prize essays, are put off to 1890.

— The *Athenaeum* is authority for the statement that the Prince of Wales has undertaken, at an early date, to open the new buildings of the College of preceptors in Bloomsbury Square, recently erected at a cost of over £16,000. The council hopes, in its new quarters, to carry on with increased efficiency the manifold work of the institution, the importance of which may be measured by the fact that more than fifteen thousand pupils, representing nearly four thousand schools, were examined by the college during the past twelve months. The council also proposes to start a fund for the purpose of establishing a training college, or of promoting some other scheme for the training of teachers; and in the mean time it is intended to set apart £300 a year, to be awarded in the shape of scholarships for intending teachers.

— The paper on 'The mutual relations of the colleges and academies' read before the convention of the University of the state of New York, in July last, by Professor Hewett of Cornell university, has been issued in pamphlet form.

— The returns from the University of Berlin this winter show an unexampled activity. The total number of students is 5,357, the largest ever reached at a German university. Of these,

794 are matriculated in the faculty of theology, 1,282 in the faculty of law, 1,297 in the faculty of medicine, and 1,984 in the faculty of philosophy: 4,062 of the students are from Prussia; while the rest of Germany furnishes 740. The foreign students number 381, the Russians coming first with 198, America following with 149. In the faculty of philosophy are 715 students from gymnasia, and 402 from real-gymnasia. The total number of instructors is now 288, including 16 in theology, 22 in law, 103 in medicine, and 147 in philosophy.

— M. Justi, who has received a flattering call to the University of Vienna, will not leave his chair of the history of art at Bonn.

— The *Pacific science monthly*, edited by Rev. Stephen Bowers, is to be issued as a bulletin of the Ventura society of natural history in the future, and published quarterly or as occasion demands.

— E. L. Greene, who has made a name for himself by his 'Studies of the botany of California and parts adjacent,' has been lately appointed a professor in the University of California.

— The March number of the *Popular science monthly* will contain a portrait of the late Prof. E. L. Youmans, engraved on steel by Schlecht. The likeness is considered remarkably vivid, while the execution of the work is much superior to ordinary book-plates.

— Henry Hemphill, the renowned brick-layer and conchologist, has presented a collection of a thousand species of shells to the San Diego society of natural history. A few years ago he gave the State normal school a series of over eight hundred mollusks, collected by himself in the west part of the United States, which was by far the best public collection on the coast.

— In the Clarendon press series of school and college text-books, three new volumes have recently appeared. Professor Sweet's 'Second middle English primer' is meant as a continuation of his 'First middle English primer,' and consists of a series of selections from Chaucer, together with a brief grammatical outline and a key to phonetic transcription. Mr. Sloman's edition of the 'Adelphi' of Terence is excellent as an elementary book, and the worst that can be said of Heberden's edition of the 'Medea' is, that it contains nothing new.

— Hungary has within its borders 143 towns, in 74 of which the Magyar element predominates, in 24 the German, in 24 the Slavic, in 6 the Roumanian, and in one each the Servian and Bulgarian. Thirteen towns are not marked by the distinct preponderance of any nationality.

— The population of Africa is estimated at two hundred millions, of whom forty per cent are negroes, and forty per cent Hottentots and Bushmen.

— The educational bureau, or museum, and the pedagogical library that Superintendent Draper is building up in conection with his department at Albany, deserve encouragement. The collections will not only be valuable in themselves, but they should be the source of inspiration and suggestion to numbers of teachers.

— The geological survey is receiving data daily concerning the recent earthquake of Feb. 6 in southern Indiana, Illinois, a small portion of Kentucky, and east central Missouri. The only accurate time-observation was that made at Terre Haute, Ind., by Prof. T. C. Mendenhall, who gives the time as 4:15:06 A.M., Feb. 6. The newspaper reports indicate an area of about 75,000 square miles in the states just given. The greatest intensity was in south-western Indiana and south-eastern Illinois. Efforts are being made to obtain the accurate boundary of the area covered, by means of circulars sent out by the geological survey.

— Mr. Carlisle Terry, one of the most efficient officers of the coast survey, who has been in charge of the magnetic observatory at Los Angeles, has been compelled, on account of ill health, to retire temporarily from the service, and has been ordered to his home at Columbus, Ga. The results of Mr. Terry's thorough work have been most important, and his services will be greatly missed.

— Among the reported discoveries for the prevention of rabies is that of Dr. Fernandez of Barcelona, who claims that a dog that has been bitten by a viper never has rabies, and cannot become rabid when inoculated. He has inoculated dogs with viper's poison, and he holds that under no circumstances will they ever become rabid.

— An automatic collecting or toll-taking device, to be attached to telephones at public or pay stations, has been invented. The mechanism in the telephone-box is so arranged that the telephone will not operate until a coin of a certain size and weight, dropped into a slit in the front, acts upon a switch-lever, thereby making electrical connection between the transmitter and the line wire. The act of hanging the receiving-telephone, after use, in the place provided for it, drops the coin into a till and releases the switch-lever, thereby breaking the electrical connection and 'setting the trap' for the next user.

— Captain Gates of the ship L. Schapp has reported to the U. S. hydrographic office that on April 19, when off Cape Horn, on a voyage from San Francisco to Liverpool, the temperature of the water suddenly rose from 42° to 44°. Judging from this that the vessel was too close inshore, he hauled off three points, and, after standing on this course for four hours, the temperature fell to 42°. The captain stated that on a previous voyage he had noticed this warm belt, and judges that it does not extend more than ten miles offshore. He believes he would have gone ashore if he had continued on his first course half an hour longer. He had not seen the sun for twelve days.

— The longest completed tunnel in the world is at Schemnitz in Hungary. It is 10.27 miles in length, with a cross-section of 9 feet 10 inches by 5 feet 3 inches, and is used for drainage purposes. The new Croton aqueduct tunnel, now in course of excavation near this city, will be much the longest tunnel in the world. When completed, it will be nearly 30 miles long, with a section much larger than that of the Schemnitz tunnel, being about 16 feet in diameter. Twenty-two miles have already been excavated.

— The International statistical institute will hold a meeting in Rome early in April.

## LETTERS TO THE EDITOR.

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The natural method of teaching languages.

Will you permit me to call attention to two misstatements in Mr. Stern's article on 'The natural method of teaching languages,' which appears in *Science* of Jan. 21? On p. 69 he says, "Why is it that the old method . . . could be shaken in its very foundation to such a degree that one of its warmest defenders writes but lately, 'It is evident to me that the old grammatical method cannot survive the assault of the natural method'?" The writer referred to as 'one of the warmest defenders' of the old method has been conspicuous and outspoken in discarding 'the old method,' both in theory and practice, for many years, and, had his name been quoted, the absurdity of the above would have been at once apparent.

Farther on, Mr. Stern says, "It would seem strange . . . that an educational journal which is not friendly [*sic*] inclined towards the method should have recently been forced to admit that 'the subject is now attracting great attention in the secondary and higher schools.'" The expression 'forced to admit' is misleading. Possibly it was intended to be so. It would be interesting to learn the exact nature of the *forcing*. By the same token it might be claimed that any statement of fact is a forced admission. It was simply given as an excuse for introducing the matter as the subject of *Interchange*. Perhaps Mr. Stern would claim that our statement that "there are twenty thousand secondary teachers in the United States" was a forced admission, but we have never so regarded it.

The Editor of The Academy.

Syracuse, N.Y., Jan. 22.

### The submerged trees of the Columbia River.

The phenomena which Capt. C. E. Dutton has so well described under the above heading in No. 208 of *Science* were observed by me in the autumn of 1870, when, in the course of preparations for a topographical and geological survey of Mount Rainier, I made a trip from Portland to the Dalles and back, and later, on my return from Mount Rainier *via* the Dalles to Portland, during the month of November of the same year. The submerged trees excited my vivid interest during these trips up and down the river; and during an enforced stay at the Cascades on one of these occasions, I made some investigations in the vicinity, which, with information I obtained from old Hudson Bay trappers and Indians, suggested to me an explanation of the backing-up of the river different from that offered by Captain Dutton. This explanation, which was embodied in a somewhat popular address delivered by me before the American geographical society in New York on March 13, 1887 (Bulletin No. 4, session 1876–77, p. 11), I venture to repeat here, for the reason that Captain Dutton assures me that he had not known of my publication on the subject, and that the explanation had not been suggested to him at the time of his investigations. It is briefly this: —

1. The valley of the Columbia River at the Cascades is a cut, considerably broader than the actual stream-bed, through over 3,000 feet of beds of basalt and basaltic breccia, which here form the axis of the Cascade range, and which rest on a loosely aggregated bed of conglomerate carrying leaf-remains and trunks of trees, sometimes petrified, sometimes merely carbonized, apparently of miocene age. This bed of conglomerate is seen to outcrop about at the river-level at the foot of the Cascades: therefore in its cutting-down or corrasion the Columbia River had already reached this conglomerate bed below the falls, and above was within thirty feet of it.

2. The river at the Cascades is a narrow boiling stream, rushing down over immense broken masses of basalt, and between steeply cut banks of basalt; which banks are, if I recollect rightly, somewhat higher than the broad forest-covered stretches of the valley which extend on either side of the stream to the base of the steep bounding cliffs. In this stretch on the north bank I observed an old stream-bed filled with rounded pebbles, through which at least a part of the stream once ran.

3. The Indian tradition above referred to says that there once existed a natural bridge at the Cascades, and that the ancestors of the present tribes (probably at no very distant period) used to cross the river here dry-shod. The form of the banks at the head of the stream lends probability to the truth of this tradition, for they appear like the rude abutments of such a bridge, which had been left after its destruction.

4. The submerged stumps of trees which line irregularly the banks of the river above the Cascades are of the same species, and generally about the same size, as the older of those which clothe the steep

slopes of the valley on either side from the water-line upwards. Their submergence is evidently, therefore, a matter of quite recent date, even historically speaking.

From the above facts and traditions I reconstructed the history of the formation of the cascades, the damming and backing up of the stream above, and the consequent submergence and killing of the trees which grew immediately along its bank, as follows: —

At the time when the general cutting of the Columbia valley had reached about the level of the present flood-plain at the Cascades, through some crack or other natural opening its waters found a passage into the underlying conglomerate bed, which, being permeable, allowed a passage of this water down stream to a point in the bed itself where it outcropped at or above the level of the lower part of the stream. Such a passage, once established, would be rapidly enlarged by the force of such an overlying mass of water as the Columbia River; and to those familiar with the corrading force of water, as shown in the stream-action of western rivers, it must readily be apparent that it would soon become large enough to take in the whole stream; that thus for a certain distance the whole Columbia would run underground, like the so-called 'Lost Rivers,' which are still found under the basalt flows of the Snake River plains. Thus would have been formed the natural bridge spoken of by the Indians. Moreover, by this lowering of its bed at this point, the bed of the river above would have been correspondingly lowered, and tree-growth would have gradually extended down to the water's edge, as it does at present.

Meantime the corrasion of this underground stream would gradually wear away the supports of the overhanging sheet of basalt, until at length they became inadequate to hold it up; and when they fell, the underground passage would have been suddenly filled, the river dammed up to the present level, and the stream also backed up so as to cover the roots of and thereby kill the trees along the lower part of its banks. Such is essentially the present condition of the stream: for the broken masses of the basalt which form the present stream-bed at the Cascades resist the wearing-away of the water better than did the conglomerate, and the river above the Cascades still stands at a higher level than it did before the falling-in of the basalt bridge.

I must admit the possibility that an actual survey of the region about the Cascades might disclose facts that would make the above explanation inadmissible, since it is founded on a very hasty and superficial examination. In spite of the fact of Captain Dutton's later and possibly more thorough examination than my own (for I have not been there since 1870), I am not quite willing to yield my theory in favor of his, for the reason that his theory involves what seems to me a geological improbability, — one which, in my experience at least, has not been supported by any observed facts. This is, that an earth movement — for such the flat anticlinal arch he assumes to account for the raising of the old flood-plain below the Cascades involves — could have proceeded more rapidly than the corrasion of as large a stream as the Columbia, so as to actually dam it up, and then have conveniently stopped, so as to allow corrasion to gain its former ascendency over the earth-movement.

S. F. EMMONS.

Washington, Feb. 8.

## A carnivorous antelope.

A few months ago, while visiting a friend on a cattle-ranch in the San Andreas Mountains of southern New Mexica, I saw what to me seemed a most abnormal habit. My friend had a young antelope six or seven months old, which he had captured when very young, and kept as a pet about the ranch. This animal is, by the way, very tame, following its master about without once offering to join its fellows, which often come in sight of the house. When offered pieces of raw beef, it will eat the meat with evident relish, and in preference to vegetable food. I have seen it eat piece after piece until it has disposed of half a pound or more, then it would walk to the corn-crib and eat corn as a sort of dessert. It also eats bread, cooked potato, and sweet-potato both raw and cooked. RALPH S. TARR.

Cambridge, Feb. 14.

## Language-teaching.

The important subject of the teaching of modern languages having been discussed in the columns of *Science*, and no definite plans having been offered by either of the writers discussing it, perhaps the original and independent views of a practical teacher will not be unwelcome.

It is obvious that a complete knowledge of a language consists, 1°, in having full command over the bodily organs through which it is either received or communicated to others, — viz, the vocal organs, ears, and eyes, — so as to be able to utter any sound like a native, to understand all that he says, and to read any book aloud in the proper manner; 2°, in mastering those fundamental rules of grammar — including those of the verbs — indispensable in order to speak and write correctly; 3°, in the possession of a fund of words and idiomatic forms for the expression of ideas; and, 4°, in the power of using these words and forms according to the special genius of the language studied.

Sounds of the human voice are the vibrations of an expired current of air, produced by the vocal organs, which (in the case of the French pronunciation) are, for the formation of every sound, in a fixed and determined position. In my book on pronunciation, 'French orthoepy,' I have indicated the relative positions of the vocal muscles for every French articulation and vowel. The learner is trained, by means of different vocal exercises, to use the instrument of speech in exactly the same manner as the natives; and, employing the same means, he must necessarily obtain the same result. These gymnastics of the voice are accomplished in a few short hours, and are an indispensable preliminary exercise before commencing the study proper of the language.

Teaching a language without the few fundamental rules that regulate it, including those of the verbs, is depriving the student of a most valuable aid and guide; while making grammar the all-important subject, especially in the beginning, is to create a confusion in his mind, and to impede his progress. I have taken a middle course; and in my grammar will be found, in a concise form, only those general rules without which nobody can either speak or write properly. My grammatical exercises have been framed with the view of initiating the learner into the idioms and construction of the language. To avoid those disconnected and commonplace phrases

generally found in French grammars, I have treated, in each of those exercises, one special subject.

I have made a synoptic table of thirteen lines, by which all verbs, regular or irregular, are conjugated, thus saving the student the monotony and annoyance of studying the verbs from memory by a new combination and arrangement. The student is thereby saved loss of time in writing endless conjugations of verbs.

To make attractive and instructive a study which is too often wearisome and sterile, I have given, in the third volume of my series, a vocabulary, divided into chapters, each containing an interesting outline of stories bearing on a special subject, and comprising a list of the most useful and important words of the language in daily use. Thus a natural chain of ideas is formed, easily remembered, and which can be made the subject of a conversation and composition, the student gaining in this way a thorough knowledge of the practical framework of the language. As soon as the student knows a few words of the vocabulary, these outlines are made the subjects of conversations between teacher and pupils, and, later on, between the pupils themselves. They are also employed in the form of narratives, by joining them together; and, by degrees, they are enlarged upon more and more. The fourth volume of my series, 'The modern French method,' comprises a series of words, idioms, and proverbs, forming skeleton narratives of travel, incident, and scenes, — romantic, dramatic, and comic, — all fitted to elevate the mind and inspire noble thoughts: there are also sketches in geography, biography, and history to be used in conversation and composition. By the study of this work, the learner acquires the framework, words, and idioms for literary style; and as every word, idiom, and proverb is properly located, the student will comprehend all their bearings by the context, and will know how to use them in their full meaning. A vast number of idiomatic questions are put upon the above-mentioned outline, and the answers are furnished by the student from the skeleton, or framework, upon which he enlarges at will. In order that the learner should acquire self-reliance, and be able to express himself freely on literary subjects, and should get an elegant style of his own, he sets down in narrative form each lesson previously treated conversationally, by which means he can give free play to his imaginative faculties.

The pupil, being constantly imbued with French ideas, and accustomed to look at things from a French point of view, adapts himself to them, and necessarily expands his mental vision: and as a great number of the subjects he treats of arouse his moral sensibility, and are fitted to excite in his heart tender compassion, brotherly love, devotion to his fellows, and self-denial, his moral capacities must be, as a matter of course, enlarged. This method is easy and simple, interesting, natural, and practical; and it relieves the student from much irksome and monotonous labor. It trains the ear to the apprehension of the spoken language, and, by a systematic training of the vocal organs, gives to the speaker a faultless Parisian pronunciation. The pupil is presented with a vocabulary so constructed that all the words, idioms, and proverbs form an intelligible outline of scenes and sketches, which the mind grasps and retains, while bringing out fully their individual and conventional meanings. The pictures are made so vivid and obvious, and the words are so suggestive, that the memory is greatly assisted, and the acquirement of a stock of words becomes a mere pastime. These words are fixed in the mind of the student by frequent and pleasant repetition, and thus memory is cultivated without straining; while, by means of idiomatic questions, educing appropriate answers, the learner is made acquainted with the peculiar genius of the French language. No English is either written or uttered during the course. The pupil finds in the book ample English explanations, and is never left in the dark; yet by degrees he becomes accustomed to think in French.

JOSEPH D. GAILLARD.

New York, Feb. 11.

## Inertia-force.

In *Science* of Feb. 11 Professor MacGregor has very courteously criticised my use of the idea which I have sought to express by the term 'inertia-force' in a pamphlet recently published. Professor MacGregor misunderstands me, however — or I misunderstand him. He quotes from my pamphlet the following passage: "If one of the opposing applied forces is greater than the other, the greater will prevail, and a change of motion will occur, occasioning an inertia-force, which will work *with* the smaller applied force *against* the greater," and then says, "The inertia-force, therefore, is supposed to act on the body by which it is exerted."

I am at a loss to understand how Professor MacGregor makes this inference from the passage he quotes. I meant that the inertia-force works ('acts' would be a better word) with the smaller applied force *against the agent which* exerts the greater force. Take this example: a train is being started by a locomotive. The forces *applied* to the train are the pull of the locomotive, and the smaller, opposing, force of friction. The pull of the locomotive prevails, but in prevailing it must deal not only with the resistance due to friction, but with the reaction (which also I call resistance) due to the inertia of the train. The friction resistance would be nearly the same whether the acceleration of the train were great or small; but the resistance due to inertia, the *inertia-resistance*, or *inertia-force*, would be always proportional to the acceleration.

The term 'centrifugal force,' although I do not like it, does not excite in me the horror which Professor MacGregor evidently thinks it should occasion. I certainly should not say that a ball swinging in a circle at the end of a string connecting it with the centre of the circle is *acted on* by 'a force directed from the centre,' but I certainly should say that the ball *acts upon the string* with 'a force directed from the centre,' — a proposition which seems to me so plainly true that I think all difference of opinion as to its truth must arise from different interpretations of the word 'force'

I suspect that Professor MacGregor and I do interpret that word somewhat differently. The following quotation from Maxwell's 'Matter and motion,' p. 78, seems to me to express my view with sufficient accuracy: —

"As soon as we have formed for ourselves the idea of a stress, such as the tension of a rope or the pressure between two bodies, and have recognized its double aspect as it affects the two portions of matter between which it acts, the third law of motion is seen to be equivalent to the statement that all force is of the nature of stress, that stress exists

only between two portions of matter, and that its effects on these portions of matter (measured by the momentum generated in a given time) are equal and opposite. *The stress is measured numerically by the force exerted on either of the two portions of matter*" (the italics are mine).

In making this quotation, as in making other quotations from the same authority in my pamphlet, I appeal from Maxwell the critic to Maxwell the author. The passage just quoted meets so many of the points raised by Professor MacGregor, that I shall trench upon your space no further now, except to thank Professor MacGregor for his general commendation of my pamphlet, and to say that I made my quotation from Minchin, not to suport my use of the term 'inertia force,' but because of its recognition of what Minchin there calls the 'kick' of a body 'against change of motion.' E. H. HALL.

Cambridge, Mass., Feb. 13.

## German constructions.

Permit me a few words apropos of the various letters called forth by my remarks about German scientific writings. To Mr. Eggert, who found fault with me so abundantly, there was no possibility of reply, as his motives were emotional, and criticism has nothing to take from emotion except sympathy to understand. Mr. Eggert wrote, "'M' assumes to judge of the literary qualifications of people who use a language with which he himself is less familiar than he is with French and English." I regret that he made this erroneous statement. But experience has shown, that, when people express opinions on subjects they know nothing about, they are not unapt to make serious mistakes, and so Mr. Eggert has blundered about my knowledge of languages.

In regard to Mr. Lea's sentence with the six pronouns in execrable succession: is it much worse than the following sample of what is grammatically good English?—"He said *that that that that that* man used was incorrect."

Mr. Frazer gives a sentence, which he kindly admits to be obscure, although it follows upon the expression of his admiration of the lucidity of that kind of *emboitement* phraseology. He admires even this sentence, Dem, der den, der die, das Verbot enthaltende Tafel abgerissen hat, anzeigt, wird hierdurch eine Belohnung zugesichert, — "because it says in eighteen words and ninety-five letters what *cannot* [*sic!*] be literally translated into English in less than nineteen words and one hundred and four letters." A very small difference! Suppose one exclaims 'tram' 'Pferdebahnwagen,'—one word and four letters, and one word and fifteen letters; or 'woodmaster' and 'Holzversorgungsinspector.' In Austria the full title of the official is kaiserlich-königlich-Staatseisenbahnholzversorgungsinspector. Such petty comparisons are, of course, only *jeux-d'esprit*, and have little argumentative value.

To return: the English of Mr. Frazer's perspicacious phrase might be; in strictly literal translation: "A reward is hereby promised to whomever tells who removed the warning sign," — thirteen words and sixty-two letters; or if we put, as would be natural in English, 'notice' instead of 'warning sign,' twelve words and fifty-seven letters. There is some difficulty, as there is no exact equivalent for *Verbot*. In English, 'die das Verbot enthaltende Tafel' might well be 'notice to trespassers,' or something of the kind. It would be interesting to known what Mr. Frazer's lengthy translation was: it can hardly have been any thing but a ludicrous rendering of word for word, and not real English at all, either in spirit or construction. The example will serve my purpose: German permits very lengthy and involved sentences, — I think of my friend, a distinguished professor, who rejoiced that the twelfth part of a work on mineralogy had come; it completed, he said, the first volume, and he hoped to find the verb in the second! — a mere droll exaggeration. But what must be the possibilities of a language when such a joke about it makes one laugh? The gist of the whole matter is, that a great many German writers do display the bad possibilities of their tongue; and when Mr. Frazer says that the *best* writers seldom or never use the involved sentences, he makes an implication about the good and mediocre writers which shows that he agrees in reality with the general opinion that German authors have too frequently a faulty and obscure style. I commend to his notice Matthew Arnold's criticisms on the Germans, or Rivarol's. M.

Boston, Feb. 10.

## On certain electrical phenomena.

At one time it was very hard for me to believe, indeed, that any person living possessed such a power as being able to shuffle across the carpet of a room, and light the gas as it issued from the jet of the burner, by simply touching it with the tip of the finger. I have at present, however, two friends, at least, among my acquaintances, who seem to be capable of performing this feat at all times, and under any circumstances. Now, I find similar phenomena exhibited to a very high degree in my own person, at Fort Wingate here. This point is over 6,000 feet above sea-level; the only water in the neighborhood is a small pond — a puddle, really — and a few insignificant springs. The air is usually clear, and highly rarified; indeed, all the conditions seem to be favorable to the exhibition of electrical appearances.

Only the other day, while pacing my room, passing, as I did so, each time, over a large woollen Navajo blanket that lay spread out on the floor, a circumstance arose which called upon me to touch the cast-iron urn that ornamented the top of a small wood-stove in the apartment, and which had a fire in it at the time. Before the tip of my index finger touched it, by a distance of fully a centimetre, there was displayed in the intervening space a brilliant electric flash, accompanied by a report that could be distinctly heard in the adjoining room above ordinary conversation. The experiment was repeated three or four times, but the display became more and more feeble with each trial; it regained its original force, however, after I paced across the blanket on the floor a few times. Additional experimentation went to show that this electrical discharge was considerably greater from the tip of the index finger than from any of the others of the hand, and gradually diminished in regular order as we proceeded to the little finger; and, further, it seemed in my case, more evident in the left index rather than in the right one. When all ten finger-tips were drawn together and then brought up to within a centimetre's distance of this stove-urn, the flash and report appeared no greater than it did from the index finger alone.

At times, apparently depending upon the meteorological conditions, my entire system seems to become thoroughly charged with this animal electricity, and most small objects crackle and snap as I handle them, leaving, as night draws near, an uncomfortable, aching sensation in my arm, and extending more or less down my side. During these same times, should my wife take any small object from my hand (as a draughting-pen, or the sponge-glass upon which such a pen is cleansed) an electrical report follows the contact, that can be distinctly heard throughout a large room. On the other hand, I had occasion to examine an injury of the back in a young mulatto girl of about fifteen years of age, a few days ago, when, with my right hand resting upon her shoulder, and my left making the required examination, there instantly followed for me a sense of the most profound relief, as if it were that all the electricity in my system had been completely withdrawn by the act. This girl, during a stay of nearly three years at Fort Wingate, has never been conscious of any electrical phenomena associated with herself, similar to those which I have experienced. Previous to coming here, I had resided about a year in Washington, where I had never observed such exhibitions, so far as my own person was concerned, and they only gradually developed at this place.

I write a great deal, sometimes six and eight hours consecutively, and I find the only kind of pen-holder that I can use with comfort is a rubber one, and even then the constant passage of the electricity is exceedingly exhausting during the most of the time. Late the other evening, having written about eight hours during the day, I threw myself upon a thick, woolen Navajo blanket which covered an iron-frame bed in my study. I was tired and nervous, and having lain there about half an hour I arose suddenly, and, being a little dazed and drowsy, I seized hold of the iron frame of the bed to steady myself: the act was followed by an electrical shock that nearly threw me to the floor, but it was not accompanied by any audible report.

R. W. SHUFELDT.

Fort Wingate, New Mexico, Feb. 8.

## Osteological notes.

In passing through the exhibition-rooms of the Museum of comparative zoölogy not long since, my attention was called to the fact that the skeleton of the Bison bonasus presented a rudimentary second metacarpal, while the Bison americanus at its side exhibited the customary fifth metacarpal; in other words, that the single splint-bone which was present on each skeleton occupied exactly opposite positions, that of the American bison being on the outer, while that of the auroch was on the inner side of the limb. This singular difference I at once attributed to carelessness in the mounting of the preparation, without giving the matter further thought. The subject, however, being again incidentally brought up, I thought it worthy of investigation.

Close examination of the parts in question showed satisfactorily that they occupied their normal position, that the diarthrodial facet for the articulation of the osseous stylet was behind and to the inside of the superior extremity of the principal metacarpal, and that there was no corresponding facet upon the outside of the same bone.

In the ruminating sections of the artiodactyla, as is well known, the second and fifth metacarpals are always reduced to mere representatives of their proximal extremities, and in some cases are entirely absent, as in the giraffe, prong-buck, and in some of the antelopes, as well as in the camels. In the Cervidae the three phalanges of the second and fifth digits are present, articulated to the distal ends of their respective metacarpals, which gradually taper to a point upwards. In some species, in addition, a small fraction of the proximal extremity of the fifth metacarpal is found. In the wapiti (Cervus canadensis) the styliform rudiments of the proximal extremities of both splint-bones are present. In the Bovinae, as a general rule, it is the rudimentary proximal end of the fifth metacarpal that is exhibited. In looking over the collection of skeletons of Bison americanus in the museum, I found no exception to this condition. In the skeletons of Bos taurus, however, although the rule held the same, there were exceptions. In one case the rudimentary proximal ends of both second and fifth metacarpals were equally developed. In several others the stylet of the second was present, but relatively very diminutive. In others, in place of a distinct rudimentary ossicle, there was an ossific deposit upon the canon-bone, simulating by its shape and position the undeveloped proximal end of the second metacarpal.

The only other skeleton of Bison bonasus in this country, to my knowledge, is in the possession of the Smithsonian institution. In answer to my inquiries, Mr. True, the curator, kindly wrote as follows: "I have examined the skeleton of Bison bonasus, and find that the metacarpals of the second and fifth digits are developed about equally at the proximal end. The largest rudiment is 55 mm. long: this is on the outside of the right leg. On the left leg, however, the larger rudiment is the inner one."

Upon the skeleton in the Cambridge museum the rudimentary metacarpals of the second digit are both equally developed, and measure 67 mm. in length, while there is not a trace of the fifth.

Owen, who is the only written authority upon the anatomy of the European bison, says in his 'Anatomy of vertebrates,' "In the bison the bones of the spurious hoofs consist, in each, of the middle and distal phalanges; and there is a styliform representative of the proximal end of their respective metacarpals articulated in the fore-foot, one to the connate trapezoid, the other to the unciform and cuneiform bones."

The modifications which prevail in the construction and number of the digits of the Ungulata are in many points of view extremely interesting. The above data are too fragmentary upon which to draw conclusions, but possibly they have their value.

D. D. SLADE, M.D.

Cambridge, Mass., Feb. 7.

## Respiration and pulse-rate of foreign residents.

I should be pleased to learn from your subscribers, born in England or upon the continent of Europe, whether they have observed any variation in the respiration and pulse-rate since becoming citizens of the United States. The reports, to be of any scientific value, should contain full statement of any change in occupation or manner of life, as well as difference of latitude and elevation above the sea, and the effect of such variation upon the general health.

EDWARD T. NELSON.

Delaware, O., Feb. 9.

# SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 18, 1887.

## *ASPECTS OF EDUCATION.*

### I. — HUMANISM.

SINCE the revival of learning, secondary education in Europe has passed through three phases, which may be conveniently called humanism, realism, and naturalism. The first is grounded upon the study of language, and especially of the two dead languages, Greek and Latin. The second is based upon the study of things instead of words, the education of the mind through the eye and the hand. Closely connected with this, is the study of those things which may be of direct influence upon and direct importance to life. The third is not, in the first instance, study at all. It is an attempt to build up the whole nature of the man; to educate, first his body, then his character, and lastly his mind. All theories of education which have taken a practical form during the last three hundred years may be ranged under one or other of these three heads. Modern education, as we know it, is an unconscious, but not the less a real, compromise between the three ends. If we consider each separately, we shall be in the best position to understand the system to which they have given rise.

It is important to remember that the reformation in Europe happened at the time when the best European intellects were directed towards the study of the classics. This was not a mere coincidence. The revival of learning, as it is called, that is, the closer and more intimate acquaintance with Greek and Latin texts, which had before been known through translations and paraphrases, was in itself the principal cause of a reformation. The critical spirit thus engendered, the dissatisfaction aroused with the teaching of the old religion, the revolt against the schoolmen, were also efficient in bringing about the reformation. The education of the middle ages was encyclopedic, in aim if not in reality. The seven-years course of study — *trivium* and *quadrivium* — was intended to comprise every thing that a man need know. Grammar taught the whole science of words, dialectics furnished a scholar with the whole armor of argument, rhetoric invested him not only with eloquence in speech but with the more graceful gifts of poetry and imagination. The science of music, the science of numbers, the power of measuring the earth and the heavens, furnished out the completely educated man. Hand-books of the middle ages intended for students cover the whole ground of human knowledge. The 'Trésor' of Brunetto Latini, the master of Dante, is divided into three books; the first book into five parts, the last two into two parts each. The first book speaks of the origin of all things. After this comes philosophy, divided into its two component parts of theory and practice. Theory has three great divisions, — theology, the knowledge of God; physics, the knowledge of the world; and mathematics, the knowledge of the four sciences which form the *quadrivium*. Practice has also three divisions, — ethics, to teach us how to govern ourselves; economics, to teach us how to govern our family and our belongings; and politics, the highest of all sciences and the most noble of human occupations, which teaches us to govern towns, kingdoms, and nations, in both peace and war. As a prelude to these nobler sciences stand the preliminary arts of grammar, dialectics, and rhetoric.

It is true that before the reformation this noble plan of education had become narrowed and formalized. The church had pressed all knowledge into its service, and no form of knowledge was highly valued which did not contribute to the service of the church. The methods of teaching became corrupted: memory was substituted for thought. There was a striking contrast between the high aims of the best part of the middle ages and the scanty attainments of its decadence; but the shell was still there, and as long as that remained, life might be poured into it.

The renaissance swept away this effort as a dream. Scholars brought face to face with Virgil and Horace, with Cicero and Plato, were so won by the charm of a new and marvellous language, that all their strength was spent in explaining and appreciating it. The literary results of the renaissance were twofold. On the one hand, it aroused the pure enjoyment of literary form and expression; on the other, by stimulating a more exact scholarship and a more minute philosophy, it urged on the human mind to inquiry and to rebellion.

Just as the stream of this revival was in full flood, the reformation came, and separated the culture of Protestants from that of the old church. We do not sufficiently realize what a wrench this was. We are so accustomed to regard Protestant-

ism as a stimulus to independence and originality of thought, that we do not consider what a loss was at first suffered by the breach with the old religion. The whole culture of the middle ages was intimately connected with the church. If we take Dante as an example, who was steeped in all the knowledge of his time, we find that, in every thing he wrote, the ecclesiastical aspect is as prominent as the poetical. There is no moment when he has not an equal right to stand among the doctors of theology and with the poets of Parnassus. Those who broke with the church of Rome had to create a culture of their own, and the culture which they created was naturally that which then prevailed in the church which they were leaving.

It was this that gave Melanchthon his importance in the reformation, and that earned for him the name of the 'teacher of Germany.' He was by nature an exact scholar. He was well read in both Greek and Latin. He may have intended to fill up the other divisions of learning, but both his taste and his powers led him to confine himself to those departments in which he excelled. He said to his school-boys, 'Whatever you wish to learn, learn grammar first.' He recommended the study of Cicero, Livy, Virgil, Ovid, and Quintilian, and among Greek writers, Homer, Herodotus, Demosthenes, and Lucian. He recommended the writing of Latin letters and Latin verses, with Latin speeches and themes for the more advanced students.

Melanchthon might have intended, if life lasted, to deal successively with other branches of the mediaeval curriculum, but his own tastes and the success of his first efforts determined his whole career. He made the study of language in all its branches current coin for Protestants, but here he stopped.

Whatever may have been the influence of Melanchthon on Protestant schools, there is no doubt that they received their form from John Sturm of Strasburg, who was rector of Strasburg high school for forty-five years, from 1538 to 1583. We find his name in the pages of Ascham, and it is very probable that his plan of study formed the model on which the new college of Westminster was organized, but his influence extended not only to England but to all Protestant countries. He was a politician as well as a school-master; and was in constant correspondence with the leaders of the Protestant party all over Europe. His great powers were devoted to an elaborate plan for teaching the Latin language, in all its extent and in its fullest elegance, to school-boys. We have a complete account of the organization of his school, and there is this remarkable fact about it,—the boys were not only made to proceed from step to step towards final excellence, but they were strictly prohibited from taking more than one step at a time. In the examinations which were held at the close of each year, it was not only a crime to have omitted to learn the set subjects for that period, but it was as great a crime to have learned more than had been set. Not only was the human mind tied and bound within the limits of a curriculum, but individual minds were prohibited from outstepping the limits of that curriculum in any particular. Sturm must be regarded, more than any one else, as the creator for Protestants of the classical system of English public-school education as it is remembered by many who are still living. In this system, boys began to learn the Latin grammar before they learned English grammar; they were set to do Latin verses before they could write Latin prose. The Latin taught was not the masculine language of Lucretius and Cæsar, but the ornate and artificial diction of Horace and Virgil, and, above all, of Cicero. There is no doubt that this system, narrow and faulty as it was, gave a good education, so long as people believed in it. To know Horace and Virgil by heart became the first duty of an English gentleman. Speeches in parliament were considered incomplete if they did not contain at least one Latin quotation. A false quantity was held to be a greater crime than a slip in logical argument. Cicero not only influenced the education of English statesmen, but had no inconsiderable effect upon their conduct. The vanity of self-inspection, the continual reference to what is dignified and becoming, coupled with a high-minded devotion to duty and a strong, if somewhat romantic patriotism, distinguished English statesmen in the eighteenth century as much as they distinguished the great orator of Rome.

There is, indeed, much to be said for humanistic training as a discipline of the mind. It is true that it deals only with words, and its highest efforts are, to decide what expression is absolutely best under certain circumstances. It is no light thing to render an English sentence, ornate and idiomatic, into a Latin sentence which exactly represents its meaning and which is equally ornate and idiomatic. It is difficult to analyze the subtle tact by which a scholar decides a particular reading in a particular passage to be right and all other readings to be wrong, or by which he determines one Latin or Greek verse to be so decidedly superior to another, that their comparative merit admits of no argument or hesitation. Any number of competently trained scholars would agree together in a matter of this kind, and yet it is entirely beyond argument that not one of them, if cross-examined

in a witness-box, could give reasons for his judgment which would satisfy a jury. The question is determined by the most delicate weighing of probabilities, by a subtle tact similar to that by which the most complicated operation of an artificer is carried on. Is not this the very process which we have to apply to the most difficult problems of life? The organon of mathematical reasoning is a far clumsier and blunter instrument than the organon by which humanistic difficulties are decided, while the organon of scientific reasoning is clumsier and blunter still. Mathematics deals for the most part with things which can be accurately apprehended by the mind. It aims, more than anything else, at exactness, and although in its higher branches it admits hypotheses of probability, yet its principal object is certainty. Science goes farther than this; it not only admits certainty of apprehension, but it claims that it should touch, see, and handle the matters with which it deals. Few results can stand this coarse analysis. If biology and chemistry refuse to acknowledge any truth which cannot be demonstrated to the senses, they put out of their reach those truths which are the most important to know, and which can be arrived at by probability alone. If methematics admits of demonstation which shall give a clear proof to any one who asks it, it removes from its sphere those judgments which rest upon the trained instinct of experts, and which can only be made clear to one who has undergone a similar training.

Regarded from this point of view, humanism was no bad preparation for active life or for devotion to any other study. It had the advantage of being small in compass, and of limits which were easily ascertained. Devotion to humanistic studies, properly understood, did not exclude application to other studies which might be considered more grave and important. William Pitt, chancellor of the exchequer at twenty-two, prime minister at twenty-four, was a first-rate humanist, as he was an excellent mathematician; but this did not prevent him from being an admirable orator, a close reasoner, a profound student of history and politics, and a political economist far in advance of his time. Much as we may regret that education in Protestant countries, especially in England, Holland, and Sweden, was narrowed by the humanistic tendency, we must not refuse to give that training all the credit which it deserves. OSCAR BROWNING.

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OF 250 railway employees examined in Budapest by Lichtenberg, 36.8 per cent were found to have impaired hearing, — a result which is certainly startling.

## PUBLIC INSTRUCTION IN NEW YORK STATE IN 1886.

THE advance sheets of the annual report of the superintendent of public instruction of New York state, Andrew S. Draper, while not containing the full tables of statistics and the appendices that will accompany the full report, enable us to judge of the work of the past year.

The aggregate amount of money expended by the department during the year was $13,896,834.08, and it covers the expenses of supervision, of normal schools, teachers' institutes, Indian schools, and institutions for the deaf, dumb, and blind. It does not include the expenses of those parts of the school system that come immediately under the supervision of the regents of the university. The total number of teachers employed was 31,325, of whom 25,373 were females. The average annual salary of teachers was $701.31 in the cities, and $261.66 in the towns. The number of children of school age — between 5 and 21 years — was 1,735,073. The number who attended the public schools at some time during the year was 1,027,767; the average daily attendance was 625,813. The whole number instructed in the common schools, normal school, academies, colleges, private schools, and law and medical schools, was 1,212,327. The average number of weeks taught was, in the cities, 39.7, in the towns; 33.6.

From the data collected, it seems that fifty-nine per cent of the school population attended the public schools at some time during the year, against sixty-nine per cent in 1870. At first sight this number seems very small, but its smallness is apparent rather than real; for all persons between the ages of five and twenty-one are reckoned as of school age, and it is therefore possible for a boy to be returned as not attending school who has been fifteen years a pupil. Furthermore, it must be recollected that among the forty-one per cent of non-attending children are reckoned all these who attend private schools and academies; and in a state like New York, which contains a very large urban population, the number of pupils in private schools and academies will be very large: so the figures as to school attendance cited above, and which first meet the eye in reading the report, are misleading. In another paragraph, however, Superintendent Draper makes the direct statement that the number of pupils in the public schools, private schools, and academies, at some time during the year, was *sixty-eight* per cent of the school population.

Mr. Draper finds that the compulsory-education act of 1874 has not only been ineffectual, but that in its present form it is hardly capable of being

made to operate successfully. He says that "school trustees elected to supervise the schools, and serving without any compensation, naturally object to being turned into constables and police officers for the purpose of apprehending delinquent children or the children of delinquent parents. Moreover, the schools are full. In most of the cities, the accomodations are taxed to the utmost. Any effectual execution of the law would at once create the necessity for additional buildings in every city of the state. But, notwithstanding these considerations, the problem cannot safely be treated with indifference by the state."

The normal-school work in the state seems to be in excellent condition. There are nine normal schools, employing 128 teachers, and having a total enrolment of 5,608. While these schools are in good hands, and doing excellent work, yet they are inadequate, for as now operated they do not fill one in ten of the vacancies occurring in the ranks of the thirty thousand common-school teachers of the state. The superintendent urges that the normal schools might accomplish larger results should they spend less time in foundation work, and confine themselves to special training and practice. Moreover, some scheme should be devised to bring the normal schools to a substantial uniformity, instead of leaving them so subject to local demands and influences as they now are.

After treating of the various other subjects that have come under his supervision, Mr. Draper concludes his report with some general observations and suggestions of more than local or state application. He inquires whether, since the state of New York is now spending $14,000,000 annually in support of its public school system, it would not be a good idea to spend a few thousand dollars, once in a while, in determining how to spend this vast sum to the best advantage. "Is our education as practical as it might be? Do we reach all the children we ought? In our ardor over the high schools, which nine-tenths of our children never reach, have we not neglected the low schools? Is there not too much French, and German, and Latin, and Greek, and too little spelling, and writing, and mental arithmetic, and English grammar being taught? Have we been as ambitious of progress in the lower grades as in the advanced? Are not our courses of study too complex? Are we not undertaking to do more than we are doing well? Is not the examination business being overdone? Are we not cramming with facts, which will soon be forgotten, in order to pass examinations, rather than instilling principles which will endure? Is not our education running on the line of intellectuality alone? Are we educating the whole man? Are we not giving up moral training more than we ought, because of the danger of trenching upon sectarianism? Is there no way of adhering to the one, and avoiding the other? Are we doing what we might in the way of physical culure? Ought not the state to do something at least to encourage industrial schools? Would we not secure better schools in the country if the township was the unit of government rather than the present school district? Does not the present arrangement help the well-to-do and leave the poor to get along as best they may? Should not the law which fixes five and twenty-one years as the limits of school age be changed to six and sixteen years? Is it not time to forbid the diversion of library moneys from their legitimate uses, or to provide that they may be expended for school apparatus instead of teachers' wages? Is our system of apportioning public moneys the wisest and the best? Is there no way of specially aiding the small, remote, and poor districts? Do our different classes of educational work supplement each other and fit together so as to make a symmetrical and complete system, and do they co-operate as they might and ought?"

As Mr. Draper adds, these are live questions, and appeal to educators the world over. To answer them, he makes the suggestive recommendation that a council of say thirty eminent educators, representing college, normal school, high school, and common school alike, be called, to meet at Albany to discuss these questions and make such recommendations and suggestions concerning them as it sees fit. In New Jersey, a state council of this sort is in process of organization, in pursuance of President Meleney's recommendation, made to the state teachers at their annual association meeting in Trenton last December; but there, it is unofficial, the first move having been made by the teachers. If it is wisely constituted, it should become an educational factor of great force in the state; and if Superintendent Draper's plan is carried into effect, New York state will have a similar body of representative advisers on educational subjects.

## *THE TRAINING OF THE FACULTIES OF JUDGMENT AND REASONING.*[1] — *II.*

I NOW proceed to show how some of our school subjects may be employed in the systematic training of the judgment and the reasoning powers. I shall follow, as nearly as possible, the order laid down in the previous article.

The lessons which I have described under these

[1] From the *Journal of education*, a paper read before the Education society, Oct. 25, 1886.

heads, when illustrating the training of the faculty of conception, will serve admirably for exercising the child in forming implicit and explicit judgments, and in making statements concerning the striking attributes of things. For material objects, chalk, salt, coal, and the common metals will afford us numerous lessons; and so will the series of inquiries into the nature, properties, and action of water, so admirably described in Huxley's 'Introductory science primer.' For form, we may use the regular solids, surfaces, and lines; while botany and natural history will provide an inexhaustible supply of lessons on life.[1] The main thing will be to make sure that the child states, in clear, unambiguous language (which he understands), only such facts as he has really observed. Classification will inevitably introduce the formation of judgments, and definition will involve the putting of them into words.[2] But better, at this stage, than classification or definition, will be a simple narrative, given by the child, of what he has seen in the above lessons, or of what has happened to him during the past week or on some specially marked occasion.

Later, propositions may be presented to the child for acceptance or rejection, those being the best which can readily be shown to be true or false. Perhaps the easiest of such propositions will concern number and magnitude. For number, the simplest problems of arithmetic are ready to hand: even such as the old catch, 'which would you rather have, six dozen dozen, or half a dozen dozen?' will be useful. For magnitude, we may take such a problem as the arranging of a number of fractions in the order of their value, or a comparison of incomes derived from investments in different stocks, every step in the proofs being clearly indicated and explained. If we desire to be more concrete, we may choose such a problem as the finding of the shortest distance between two points, — placing the two points on the blackboard and letting a piece of string hang in a loop between them, showing how it projects beyond them when pulled straight; and then beginning with it straight, and showing how its ends must approach one another in order to allow the string to hang in a loop; and so on through the many simple problems of practical geometry. But the opportunities for exercising judgments are too numerous to need particular mention. Let us only bear in mind the order of their difficulty, and very soon introduce reasoning side by side with them.

At an early stage, you will remember, the child is to be encouraged to search for causes. Here, again, a wide field lies before us. The only difficulty is what to choose. Again, our only guide is the order of nature and simplicity. The reason why fire burns the hand, or why a book, when let go, falls, is difficult and complicated. But it is simple to discover why, if I divide a sheet of paper into four equal parts and take three of them, I get the same amount as when I divide it into eight equal parts and take six of them. At a much more advanced stage, we may attempt to find the reason why, if a number is divisible by nine, the sum of its digits is also divisible by nine; while all the simpler theorems of abstract geometry will supply the young inquirer with numberless examples fairly within his power — the theorems being put in the form of questions (why is a certain fact true? or, is it true or not true?). The main difficulties about causes lie in there being more than one of them at a time at work, and in their being hard to find. At first, therefore, the cases we choose should involve only single causes, and those very evident. Later we may proceed to such lessons as those on the forms of water, in Huxley's 'Introductory primer,' which I have already referred to, and which introduce more than one cause, — change of temperature and change of pressure, for instance, in the cases of evaporation and condensation. But even here we may make things much simpler by taking one agent at a time and noting its effect, instead of seeking for all the causes of some phenomenon. So we may note the effect of heat and of cold on water separately, the nature of steam, the effect of sudden change of density on moist air in the bell of an air-pump. A most interesting lesson may be given by gathering from our pupils, and discussing, all the instances we can of the disappearance of water — apparently into the air: clothes hung up to dry, wet pavements after a shower, water in a kettle boiled away, etc., etc. Again, the re-appearance of moisture from the air: the cold plate held over the steam from the spout of a kettle, the moisture on the outside of a glass of iced-water, dew when the sky is clear and the night fine, the washing-house, etc., etc. Then, the experiment with moist air in the bell of the air-pump, — the formation of the cloud due to the sudden lessening of pressure, the cloud depositing its moisture on the glass, and so on. We note the frequent, if not unvarying, concomitant in each

[1] See the admirable list of lessons under the heads of 'Form and space: Material and force: Life and organic products,' given by Dr. Wormell, in his paper on 'The teaching of elementary science,' in the *Educational times*, March, 1886.

[2] By *classification* and *definition*, I, of course, do not mean here the complete, full-grown acts of the adult, but the imperfect gradually-growing acts of the child. We are too often given to ignoring that there must be a growth and progress in these processes as in every thing else which a child *himself* does.

case, assume it as a cause, make further experiments on this assumption, in the way described in the 'method of experiment,' given above.

Causes may also be dealt with in our history lessons in numberless ways,— especially when the children are encouraged to bring their practical knowledge of modern things to bear on things of the past. The causes of the English settlement in Britain, of the invasions of the Norsemen and Danes, can be made fairly clear by the light of modern emigration and immigration. Why the English chose John for king, and their fellow-subjects on the continent (at least some of them) chose Arthur, will not be difficult for the children to discover; while, starting from our modern agricultural troubles, we may attempt a more elaborate chain of reasoning and accumulation of causes in explanation of the peasant revolt in the latter part of the fourteenth century. I do not think it will be needful for me to go into detail, — the demands of the peasants, the actual occurrences of the rebellion, and the events which immediately preceded and followed it, will suggest sufficient causes to the teacher and his pupils, and into these, investigation may then be made. Nor need I point out how strikingly suggestive of an explanation recent events have been, — distress of a general character, agricultural distress and disagreements, political discontent, the introduction of the element of rowdyism, socialism, wanton destruction of property by the regular London mob; even the guardians of order appear to have been as paralyzed and useless in this town of London on the one occasion as on the other. The analogy is strikingly complete. But we must be careful. Analogies are dangerous things, and are wont to carry us too far, and to make us read into a case evidence not really there. They should *suggest* the direction and nature of our inquiries, rather than be taken as in themselves sufficient explanations. But, after all, the great thing in work of this kind is to choose our subject-matter from common every-day events and things, or to bring what we choose at once into as close a relation as is possible with every-day experience and modern doings; moreover, we need not exhaust, or attempt to exhaust, all the causes for our phenomena. Provided that the children are made and *kept* keenly aware that there are other causes besides those we are considering, we shall do no harm in confining ourselves to the most prominent.

In the work we have been describing, we shall gradually have advanced from individuals to classes, — the statements at which we have been arriving will have contained predicates more and more general, and more and more abstract. Now we may begin to check and correct misstatements, to curb exaggerations, and to encourage the child to make more marked distinction between fancy and reality. We may begin some simple deduction, consisting of the application of some simple general principles, or general conclusions, to the explanation and solution of particular cases. Arithmetic and algebra — and, later, some of our language work — will be found of great assistance here. We could hardly begin with any thing better, perhaps, than the deduction of the rules for the multiplication and division of vulgar fractions from the general principles that regulate the nature of a vulgar fraction, and from the general principles of multiplication and division.

The ways of doing this are numerous, and familiar to every one: we, of course, generally begin by establishing the rules referring to those changes in the form of a fraction which do not affect its value, and in making clear the fact that the numerator and denominator of a fraction may be treated as the dividend and divisor of a sum in division; or, to put it concisely, such an expression as $\frac{2}{3}$ of 1 is the same as $\frac{1}{3}$ of 2. But whatever plan we adopt, of this we should take the greatest care, — that our reasoning is strictly and honestly deductive, and that its wording and its cogency are both thoroughly understood and appreciated by our pupils. This, however, is just the very thing that teachers, as a rule, will not take the trouble to do. They are in too great a hurry to get to the working of sums, — the mechanical manipulation of figures or symbols. This they seem to look upon as the great end of arithmetic work; and, when their pupils have applied a rule, never clearly understood, to some hundred perfectly mechanical examples, the teacher will lead them on with the utmost complacency to another mechanical exercise. Shall I be exaggerating if I say that more than half the teachers of arithmetic to children are unable to explain clearly to any one, when the time for explanation comes, the principles of, say short division? Not because the matter is abstruse and difficult, but because they have never thought it necessary to understand those principles.

The principles of the method of deduction, however, will come out more clearly in some of the problems of algebra, — such as the theory of indices, — and in simple propositions of theoretical geometry. It is lamentable how seldom one gets so easy a piece of reasoning as the theory of indices clearly and correctly set forth by pupils whom no diabolic complication of quantities and signs and brackets can dismay. They can manipulate almost any thing; they can reason out nothing.

The former is good enough in its way; but to omit the reasoning is, to my mind, to omit the most valuable part of the training. The text-books are, in a measure, to blame for this. We want the stages of the work more clearly marked, — the first assumption with regard to $a^2$, $a^3$, etc.; the more advanced assumption with regard to $a^n$, with the involved assumption that $n$ is a positive integer; the first deductions as to the results of $a^n \times a^m$, and $a^n \div a^m$; the desirability of extending our notation, and introducing indices of *any* value; the necessity for a further assumption; our right to assume that $a^m \times a^n$ shall equal $a^{mn+}$ for *all* values of $m$ and $n$; the results of this assumption when applied to explain the meaning of $a^n$ when $n$ is zero, negative, and fractional. All these should be clearly marked, and clearly discussed; and, so treated, I know of no piece of elementary deduction more invigorating and satisfactory to the young learner. In geometry we usually fare better, — at least, in the text-books the reasoning is well linked and clearly set forth. The deductions are simple, and they have this great advantage, that they can be immediately put to use and be made to produce further deductions, while their value in practical work can be constantly exhibited. All this gives the child a sense of increased ability, progress, life, — which is so fascinating to him, and to all of us. It dispels the depressing feeling of futility which spoils so much of our work, and makes the school-room a tread-mill. But even in geometry the nature of the reasoning, and its limitations, are rarely sufficiently brought home to the learner. He is allowed to go on without an idea of how much, or how little, he has proved. How many, for instance, can explain why the induction of Euclid, i. 4, is a general truth, not limited to the case of the two particular triangles? Again, in language, analysis and parsing may afford excellent examples of the application of general principles to the explanation of particular cases, as may the correction of sentences in which the grammar or arrangement is faulty. But then we must be careful not to introduce distinctions which the language itself has never observed, or has long ago discarded. (The new Eton Latin grammar is a terrible sinner in this respect, with its aorist, and its array of tenses in the infinitive.) And we must abandon all such rubbish as that 'the second of two nouns is put in the genitive.' As to how the grammar of the mother-tongue, or of any other tongue, may be built up inductively, I need say nothing here. I have already more than once enlarged on the topic. Those who are still inquisitive as to my views and plans will find them fully set forth in my 'English grammar for beginners'[1] and my 'First lessons in French.'

Our next stage consists of the criticism of the statements of others, complex reasoning, and chains of demonstration. With regard to the two last, I have already somewhat anticipated myself, in what I have said about geometry and algebra. With regard to the first, I cannot do better than recommend exercises in the logical conversion of propositions and immediate inference. The rules are simple, and can be readily understood. They will be found, clearly set forth, in Mr. Jevons's little book, lesson x. From these we may pass to exercises in the detection of logical and material fallacies, which will be found both entertaining and highly useful. Mr. Jevons gives all the help that will be needed in lessons xx. and xxi., and likewise supplies us with many excellent examples — which may be supplemented from the well-chosen examples in Dr. Ray's hand-book of 'Deductive logic' (published by Messrs. Macmillan & Co.). Those which touch upon the personal experience of the learner will be the best. With regard to algebra and geometry, I will merely add that I think the first lessons in each should be much more carefully treated than is usually the case. In beginning algebra, we pass from the particular instances and particular symbols of arithmetic to general cases of number and general symbols; and we should be at the pains of making quite clear the nature of the change, the enlargement of limits, and the practical value of the new treatment. All this is far too much hurried over, as a rule; and an excellent opportunity for exercising the reasoning powers, and for what is even more important, exciting the curiosity of the pupils and displaying the practical utility of the work about to be attempted, is lost. As professor De Morgan pointed out, there is much to be learned from contrasting the proofs of $\frac{a+b}{2} + \frac{a-b}{2} = a$, or of $(a+b)(a-b) = a^2 - b^2$, with similar propositions in arithmetic; while the early introduction of problems involving simple equations is far more valuable and stimulating to the beginner than all the clearing of brackets, and simplifying of fractions and the rest, with which he is usually indulged. The corresponding work in geometry is the passing from the particular cases and inductions of practical, to the deductions and general truths of theoretical work. We should dwell upon the limitations of our earlier work; the reasons why a practical proof, such as that in

[1] In especial, I would refer to the carefully graded lessons by means of which I arrive at the definitions of the parts of speech, and to the lessons which show how, by *induction*, we may, and should, arrive at the rules relating to the order of words in a sentence, and to the use of stops.

Euclid, i. 4, holds generally, while we need something more than practical experiment to prove, say, that vertically opposite angles are equal, or that the three angles of any triangle are always together equal to two right angles. The need for proofs that are generally true may be brought out very clearly in such a matter as the consideration of the best practical methods for measuring plane surfaces, or some other similar work. In any case, let us bring home to the learner the need for more general proofs, and the nature of the method adopted for obtaining them; while, all through our geometrical work, let us keep in mind how refreshing it is to be allowed to see and appreciate the bearing of theory on practice, — the practical utility of the results of our theoretical work. Once again, what better means can we have for exercising pupils in mixed inductive and deductive reasoning than political economy? We may begin with a story from Miss Martineau's collection, — or, to be more precise, we may take 'The shipwrecked sailors,' from Mrs. Fawcett's 'Tales in political economy,' and work up to the question as to whether luxurious expenditure and waste are good for trade, or to the great problem of demand and supply, and the price of commodities, — making deductions from the principles at which we arrive, and testing them by comparison with the results of practical experience.

I will conclude by reminding you, that, for pure induction, you will generally have to rely on the physical sciences, — of which botany, energetics (if I may use the word), and chemistry will be the best for school purposes; while, for deduction, the whole field of mathematics lies before you. I may add that you will find an excellent model lesson in induction on the 'pile-driving machine' in Professor Payne's 'Lectures on education.' In mathematics, perhaps the best and simplest example of induction suitable to beginners is the well-known 'binomial theorem' for positive integral indices.

H. COURTHOPE BOWEN.

## *MODERN BIOLOGY AS A BRANCH OF EDUCATION.*

A GLANCE at our higher educational institutions to-day shows a tendency toward an increase in the importance of biological science. Everywhere biology is being separated as a distinct department, and at least one school is founded for the express purpose of pursuing this study. An increasing stress is being placed upon this science as a part of a liberal education, and its number of students is growing rapidly. We wish, in a few words, to show why this is so, and to give the grounds upon which biology is every year demanding more recognition.

Biology is sometimes called a *new* science. This is not because the subject-matter treated of is new, nor because living nature is a new subject for study, but rather because the method of study has so changed in the last twenty-five years that the study of life appears under an entirely new aspect. As material for a descriptive science, animals and plants have been studied for centuries, but biology as a dynamical science is of comparatively recent growth. Modern biology is neither zoölogy nor botany, though it of course includes the study of both animals and plants. The terms 'zoölogy' and 'botany' usually convey to the mind the idea of long names and tedious descriptions, with an overwhelming abundance of uninteresting details, and the student well asks what is their value to him. If biology offered to its students to-day no more than a description of animals and plants, it would be well questioned whether it should in justice demand any greater attention than has been allotted to zoölogy and botany for fifty years past. But scientific teachers are beginning to see that the learning of names and descriptions should bear about the same relation to biology that the learning of dates bears to history. Some dates must be learned in studying history, and some names and descriptions must be learned in studying biology; but the former does not constitute history, nor the latter biology. The rapid extension of observation on vital phenomena, and the more careful thought thereon, have been teaching scientists to comprise large groups of facts under general forms, and thus to deduce general laws regulating life. It is the study of these principles which is coming more and more to constitute the science of biology. The enormous multiplication of species is making zoölogy and botany unwieldy subjects to be treated in any general way. Classifications have, by reason of recent discoveries, grown so intricate and complicated that they can no longer be taught to the general student with any degree of satisfaction. But this very increase in discovery is adding to science new laws, is rendering intelligible the older ones, so that the material for the study of biology, as separate from zoölogy and botany, is becoming more abundant. Biology is thus rapidly freeing itself from the dry bones of detailed classification, and becoming of more and more interest and significance to the general student. Biology is growing to be more the study of life-principles as illustrated by animals and plants; is becoming, therefore, more a study of life, and not so much as it has been a study of living things.

It is biology with some such scope as indicated above, that is now claiming to be recognized as a necessary part of a liberal education. Education

has three primary objects: 1°, it should give mental training; 2°, it should give a certain amount of practical knowledge; 3°, it should place the student in such contact with philosophical thought that he may be able to understand the trend of thought at the present time. The new science of dynamical biology claims attention as assisting in the accomplishment of all three of these objects.

The value of biology as a means of mental discipline is chiefly in exercising the powers of observation. No course in this study is in any way complete without an accompanying course in laboratory work, though the amount of such work may be sometimes very small. There is nothing better adapted to teach the student to use his eyes accurately than a course in laboratory work upon living things, including microscopic study, dissection, and analysis. The value of this sort of education is, indeed, too plain to require more than a notice.

There is undoubtedly a growing demand in this country that studies should have a practical value; and for any new study to force its way into wide acceptance, it must be able to show that it has some direct utility. Now, biology is by no means a 'bread-and-butter' study, unless, perchance, it be to those who aim to teach it. But it does give the student knowledge in those directions which Spencer calls the essentials of education, and which are too often neglected. It teaches him to be a good animal. Aside from its value as a preliminary medical training, biology gives an education which every one needs. There is hardly a discovery of the century which bids fair to produce more influence upon the human race than the germ theory of disease. This discovery is rapidly modifying methods of dealing with contagious diseases; and it is an injustice to the student to send him into the world without a knowledge of these general facts, the significance of sanitary precautions, and the methods of avoiding disease. But aside from such facts, it is hardly possible to overestimate the value to every one of a study of the laws of life. The student learns that he, too, is an animal, and under the influence of the same laws which he finds elsewhere, and comes slowly to realize the meaning of many of these laws with a vividness which can be produced in no other way. He learns of the effect of surroundings upon the growth of living things, and that animals are largely what circumstances make them. He gains a strong impression of the lasting effects of habits, sees that nothing is too small to be without its influence. He is brought face to face with the degrading effects of parasitism in all its forms; sees that inactivity is universally followed by degradation, and that only active animals can rise in nature: learns that luxury is always the precursor of degradation, while adversity, if it be not so great as to destroy, is sure to exalt the animals under its influence. All of these factors, together with the physiological laws which he must obey, and hundreds of others of smaller import, are or should be forced upon a student who has taken a good course in biology; and these facts, though not teaching men to earn a living, do teach them to make better use of their lives.

But, after all, the chief reason why biology is obtaining a greater recognition as a necessary branch of education, is none of these, but rather because of its relations to philosophical thought. Modern biology represents to us a final step of the belief in the universality of law. A comprehension of its import is therefore necessary to one who wishes to keep abreast of modern thought. From the time when the curiosity of early man was aroused concerning nature around him, he has been constantly asking for causes. At first the only sort of causality of which he had any conception was that of personality, and he therefore conceived that behind every phenomenon of nature there was a personality. The explanation of causes was thus polytheism. Slowly and irregularly there arose from this belief the nobler conception of monotheism. But all through the past centuries the God of monotheism was regarded as forming no part of nature proper, but as holding aloof from it, and interfering now and then to perform miracles. Indeed, even today we find not a few who still retain this conception, and scarcely see any room for God except to explain mysteries. But these mysteries have been disappearing. Little by little did more extended observations show that nature acts with uniformity, and there thus arose, vaguely at first but more clearly afterwards, the idea of natural law. Since the time of Newton's discovery of the first grand law of nature, there has been inaugurated a new method of research. Science, as we now understand the term, has arisen, and has been trying to reduce the varied phenomena of nature to an order, to discover the laws regulating them, and to investigate the former mysteries of nature, and explain them by the simple application of discovered law. One after another have the various realms of nature been studied, and one after another have they been comprehended under the universal reign of law. Nature's mysteries have been constantly uncovered and rendered intelligible. The thunder is no longer a bolt thrown by an angry deity, nor is the north wind the breath of an avenging god; but each falls in with the general order of nature, and is explained by the

action of known laws and forces. Until within very recent times, however, it has not been imagined that the phenomena of life could be brought under the same laws which regulate the inorganic world. Life seems so different from all that is not living that it has been regarded as standing by itself. It is, withal, so mysterious that it has at all times been regarded as a direct instance of almighty power, and living things have been looked upon as miracles concerning which it was almost sacrilege to question.

Modern dynamical biology owes its existence to the attempt to apply to the organic world the same course of investigation which has been successful elsewhere; nay, indeed, to apply to life the same chemical and physical laws which govern the inorganic world. The first great step was taken in this direction by Darwin when he tried to show that species were not to be considered as special creations, but as having had a natural origin. Zoölogy and botany, as they had been studied before, were simply statical sciences, merely studying and classifying facts as they were found. Modern biology is a dynamical science, in that it attempts to explain the facts of life. All vital phenomena have been attacked with this purpose in view, and biologists are now strenuously trying to come to some explanation of the fundamental fact of life itself by the application of chemical and physical laws.

It is plain enough that such study and such conclusions are of great significance to the thoughts and beliefs of every one. It is not strange that these conclusions, removing as they do so many miracles from nature, should be regarded by many as conflicting with all theistic belief, for we are all inclined to think a fact is understood when it is comprised under any law. But it is equally evident that more careful thought shows that, even accepting these conclusions of biology, we are by no means able to say we have fathomed life, for we do not understand the reason for the existence of any single chemical or physical law. But whatever be the conclusion which may be reached as to the ability of biologists to explain life-principles, or as to the significance of the explanation when reached, it is certainly a necessity for any one who wishes to comprehend the thought of the times to get acquainted more or less intimately with these attempts of the *new* science. The students who go out from our higher schools are to take a stand among the foremost thinkers. Indeed, they are, it is hoped, to advance the thought of the world. Whether they be theologians, philosophers, scientists, or teachers, it is necessary for them to realize the meaning of the application of dynamics to life: they should understand the positions held by advanced biologists, and know at least the sort of arguments used to support these positions. In this fact, then, lies the essential reason for the growing importance of this study. As a branch for special study, biology has its own fascination and defence. But as fast as it becomes freed from the burden of detail, and becomes a study of life-principles, just so fast will it become recognized as a necessary part of the education of the general student

H. W. CONN.

## THE FRENCH LYCÉE.

WHILE much of the educational inspiration of the day is drawn from Germany, it must be borne in mind that France is actively engaged in thinking out the great problems which are of common interest to all nations. We hear much of the 'gymnasium' and 'realschule,' but not so much of the 'lycée.' This word should call to our minds as definite and accurate an idea as the word 'gymnasium' does. The material for such an idea is contained in a short account of the curriculum of a French lycée recently published by Mr. W. H. Fraser of Upper Canada college.

The word 'lycée' itself, in its present application to the secondary colleges of France, dates back to Napoleon Bonaparte, and was given by him to them when he re-organized the university system. The name was afterwards changed to 'collége royal' at the restoration and under Louis Phillippe, but was changed again to lycée in 1848. 'Lycée' is the French form of λύκειον, the gymnasium near Athens, where Aristotle assembled the members of his school of philosophy. By extension it was applied to certain schools in Paris devoted to science and literature. Almost every considerable city and town in France has now its lycée, whilst in Paris there are several of them, for example, Lycée Henri IV., Louis-le-Grand, St. Louis, and others, — enormous establishments affording accommodation to many hundreds of students, both *internes* and *externes*, as the students in residence and the outsiders are respectively called. Until recently, only boys enjoyed the privileges of these colleges, but now provision has been made in several places, including Paris, for the education of girls also. Their colleges are entirely distinct, and the programme of those for girls is, in the main, a modified form of that prepared for their brothers.

The whole course of the lycée should be completed, and generally is completed, by the pupil before he has reached his twenty-first year. It may be finished, however, by the eighteenth year. This is not astonishing, when we reflect that

the pupil enters at an early age, that the sessions are long, and that he moves forward without break or interruption through a programme carefully weighed, measured, and detailed beforehand. The class hours are now twenty a week, as compared with twenty-four previous to 1884, a reduction owing to the fact that evidence of overwork had become apparent.

The whole work is divided into eight classes, numbering from eighth, as the lowest, up to second, which is followed by the classe de rhétorique and the classe de philosophie, not numbered. There is below the eighth a preparatory class, which is, in its turn, preceded by an elementary division of three classes. Thus the boy may enter very young, and may be promoted to the eighth class when he is nine years old. The work in the preparatory class consists of French together with German or English; to these alone four hours out of the twenty are devoted: also history, geography, and two hours a week for arithmetic, together with an hour each of object lesson and drawing. At nine years of age, then, the collegian is fairly launched upon his career. The number of hours devoted to his mother-tongue is still the same, nine; he has still four hours a week in English or German; history takes an hour and a half, and geography the same; arithmetic and object lessons take three hours, while drawing, as in the preparatory class, occupies an hour. The next year, if he has not failed at examinations, the pupil proceeds to the seventh class, and must be at least ten years old. In it, the division of time to the various subjects is precisely the same.

When the pupil is at least eleven years old, and in the sixth class, i.e., at least six years from the completion of his course, a marked change takes place in the subjects of study, and in the disposition of time. His native language drops at once to three hours a week; he has been exercised in it for years nearly half of the whole class-time, and his style has been largely formed. Perhaps this early and thorough practical exercise in his mother-tongue is a reason why almost every educated Frenchman can express himself in language always elegant, smooth, and concise. What is lost by French and modern languages in the programme is gained by Latin, which rises at once to ten hours a week. History also gains an hour, arithmetic and science losing an hour, while drawing gains the time which they lose. Thus, when the Latin grammar and 'De viris illustribus Romae' is begun, the boy is reading in English Miss Edgeworth's 'Tales,' 'Evenings at home,' and Miss Corner's 'History of England,' or Benedix's 'Der Process,' 'Griechische Heroengeschichte,' etc., in German, with exercises in reading and conversation. In arithmetic, he is doing vulgar and decimal fractions, while in drawing, he is attempting architectural design and the human figure.

In the fifth class the hours are precisely the same until January, when Greek is begun, and to it two hours a week are devoted. The Latin has now got as far as the 'Fables of Phaedrus,' 'Cornelius Nepos,' and the 'Metamorphoses of Ovid.' The Greek is elementary, but in English, Sir Walter Scott's 'Tales of a grandfather,' and other works of similar difficulty, stand side by side with Grimm's 'Fairy tales,' Andersen's 'Tales,' and 'Der Eigensinn' of Benedix. The history corresponds to the language studied, so that in this class Greek history is almost exclusively read. Arithmetic has got as far as the rule of three, and geometry is continued. An elementary course of botany balances a similar course of zoölogy in the preceding year.

In the fourth class, only two hours are devoted to the mother-tongue; Latin has six and Greek six hours; modern languages, history, science (including mathematics), drawing, two each, and geography one. French classical authors are read, Caesar, Ovid, and Virgil, in Latin, conjoined with Latin composition. In Greek, Xenophon, Lucian, and composition are done. Lessing, Musaeus, Kotzebue, and Hoffman, with De Foe, Irving, etc., are read in German and English. Roman history is continued, while a course of geology replaces the botany of the preceding year.

At not less than fourteen years the third class is entered, and the work becomes heavy. In this class, mathematical work increases, and has three hours assigned to it. Latin and Greek have each five hours, with modern languages about as before. It would be tedious to go into detail in all the classes; the principal difference to be noted in the development of the scheme in the next three years is the increasing attention given to mathematics, physics, and history.

At fifteen years, if the boy be clever, he is in the second class. After the completion of this year's work, the programme divides into classe de rhétorique and classe de philosophie. The French classics are continued in the second class, and the older French literature and philology are studied, together with the history of literature. Virgil, Horace, Cicero, Livy, and Tacitus are read in Latin; and Homer, Euripides, Plato, Xenophon, and Plutarch in Greek. In the living languages, pieces from Goethe, Schiller, Hauff, Shakspeare, Goldsmith, Walter Scott, and Dickens are read, and the mathematics go about as far as the end of quadratics.

As stated above, the course now divides into

two classes. In the classe de rhétorique, the languages prevail, while in the classe de philosophie, metaphysics, mathematics, and the natural sciences prevail. A good idea of the proportion may be obtained from the time devoted to each subject. In the classe de rhétorique, French, Latin, and Greek have each four hours; modern languages, history, two hours each; mathematics, etc., three hours, and geography one. In the classe de philosophie, mental and moral science and logic, and the French authors, occupy eight hours, Latin and Greek one, modern languages one, and history two; science (including arithmetic, algebra, geometry, physics, chemistry, and physiology) has eight hours. A fair idea of the difficulty of this final year's work may be obtained by a glance at the authors in the classe de rhétorique. Nearly all the principal French classical authors are read; in Latin, Terence, Lucretius, Virgil, Horace, Cicero, Livy, Tacitus; in English and German, Shakspeare, Irving, Byron, Tennyson, Dickens, George Eliot, Lessing, Goethe, and Schiller; a good deal of modern history is added, with plane and spherical geometry and some chemistry. It might be stated that two hours a week are devoted to drawing, but that in the higher classes it is considered an extra.

If we reduce the above sketch to percentages, taking into account the whole time of the student, from entrance into the eighth class till the end of his course, we obtain the following: —

Subject, French, 20.62 per cent; Latin and Greek, 33.74; modern languages, 12.23; history and geography, 14.68; mathematics and science, 14.68; mental and moral science, 5.00; drawing, 1.25.

In this course some things are obvious. The preponderance given to language and literature, Latin and Greek, is especially noticeable. It cannot be said that the programme is a light one. Another point is, the very small part which options play in it; certain options are allowed to those who intend to become teachers of the natural sciences or mathematics, otherwise the framers of it seem to take for granted that every boy should go through the same course of mental gymnastics. For those who wish to study a profession, or for such as wish to specialize further, the university is open, and the university course presupposes as a basis the broad, general culture of the lycée.

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DURING the winter of 1885–86 there were 14,633 students in the Italian universities: 3,894 of these were at Naples, 2,073 at Turin, 1,216 at Rome, 1,163 at Bologna, 1,008 at Padua, and 1,005 at Pavia. At Ferrara there were but 39. Of the whole number, 5,195 were students of medicine.

## WHEN SHOULD THE STUDY OF GREEK BE BEGUN?

THE biennial conference of the head masters of the great English schools and colleges always develops some interesting discussions on educational topics of current interest, as well as some very uninteresting ones on matters of purely local interest and importance. At the meeting in December last, Dr. Fearon of Winchester moved two resolutions regarding the study of Greek, and spoke at length in support of them. The resolutions read, 1°, that it is desirable that the teaching of Greek to boys should be begun at a later age than it is at present; 2°, that it is desirable that a knowledge of Greek should not be required for admission to the classical side of the public schools.

In the published report of Dr. Fearon's remarks, we read that he began by explaining what he meant by the words, 'at a later age than at present.' He said that he had recently himself collected statistics, and found, that, of 385 boys now learning Greek, 213 had begun at ten or earlier, and of these 213, seventy-four had begun at nine or earlier. The average age was ten, or rather younger. He had also consulted a number of preparatory school-masters, and, almost without an exception, they put the time that it took them to prepare boys in Greek for admission into public schools at from two to three years. The first proposition he wished to establish, was, that the cause of Greek would not suffer by raising the age of beginning from ten to thirteen. For the last year and a half he had kept accurate records of all boys who had passed through Winchester, and he had submitted their records to his staff. It was difficult to arrange particular facts in a way that would carry general conviction, but the inference that he and his assistant masters — almost without an exception — had drawn, was, that boys who had started Greek at ten were no better than those who had started at eleven. Some of the most able and brilliant classical scholars at Oxford and Cambridge had begun Greek after they were fifteen. But he did not rest his case on his experience with promising boys, who, it might be argued, would come out well under any system. The facts as to backward boys could not be got over, and were most humiliating. Of thirty-five boys who had lately entered in the bottom division at Winchester, only three had reached a point in the school where they read anything harder than the shorter form of an elementary Greek reader. One of them had studied Greek for three years before entering, and for seven years at Winchester; two others had reached that point after three and a half

years; and thirty had not reached it at all. Such a state of things appeared to him intolerable, and he had fully made up his mind to deal with it.

The experience of the continent was wholly opposed to the English plan. At Basel, no language except the mother-tongue was learned till ten, then Latin was begun, and French and German not till thirteen. The evidence from Germany was more pertinent, for there both systems had been tried. In the gymnasia of Hanover, before the year 1866, Greek had been begun in *tertia* (average age thirteen), whereas in Prussia it was begun in *quarta* (average age twelve). After 1866, the Hanoverian system was brought into uniformity with the Prussian, and this was continued till six years ago, when it was determined not to begin Greek till fourteen. The testimony of the professors of Hanover is, that, at eighteen, boys know just as much Greek by beginning at fourteen as by beginning at twelve.

Passing to his second proposition, Dr. Fearon maintained that other subjects were squeezed out by the premature study of Greek. In the last five years they had had boys from 135 preparatory schools. He had sent a circular to sixty-two of the more important among them, and received answers from forty-five. One of the questions he had asked, was, "Do the requirements of public schools compel you to disregard subjects to which you consider more importance ought to be paid?" To this question, twenty-one had answered 'no,' and twenty-three 'yes,' but he confessed that the question was a wicked one, and that he could hardly expect masters to pass condemnation on their own system of teaching. In this matter they must go behind the judgment of preparatory masters, and he found by experience that it was precisely in this matter that preparatory masters erred and came short. They sent to Winchester, boys admirably grounded in Latin grammar, but sadly deficient in English history and French. In the last year he had been advised to reject boys for total ignorance of French. And he found, moreover, not only that the most backward boys in Latin and Greek were the most backward in French, but also that they were comparatively more backward in French than in classics, proving that all their energy had been put into Greek and Latin. The only safe guide in this question was to look to the training of boys' minds and education generally. To judge from the experience of the teachers of lower forms, and his own experience as an examiner, the boys who were best at a mechanical knowledge of Greek grammar were those who were getting least good as to the culture of general intelligence. He was convinced, from his own observation, that the two main difficulties of young boys arose from the multiplicity of subjects, and from the number of subjects all of the same kind. Their brains got perfectly muddled by being driven from one point to another. So far from the study of Greek suffering by the change, he believed that it would gain. Boys would come more freshly to the subject at thirteen or fourteen, with minds more matured, and able to see the points that masters were driving at, and we should rid of one absurdity our present Procrustean education.

In conclusion, he recommended: 1°, That the study of Greek should not begin before the age of thirteen or fourteen, and that it should not be introduced at all in the entrance examinations of public schools. This step he intended to carry out himself. 2°, That Greek should be rigidly excluded from examinations for entrance scholarships. Latin and English would afford a much sounder test, and it would be a great advantage to have from the first the teaching of Greek in their own hand. 3°, He would give up Greek with boys who showed no taste for Greek, or who intended to leave school at seventeen. He knew that this declaration would lose him votes, but he could not himself continue the system which allowed boys to be studying Greek delectus for ten years. They could not dictate to preparatory schools, but these would follow if the head masters gave them a lead. By thus postponing and limiting the study of Greek, they would do nothing to injure the cause of Greek scholarship, and they would do much to set the education of the country on a more satisfactory basis than it was at present.

Familiar as this sort of argument is in the United States and on the continent of Europe, it is still considered ultra-radical in England; and it is somewhat surprising that Dr. Fearon's resolutions and remarks met with no greater opposition than they did. In fact, a number of head masters sided more or less strongly with Dr. Fearon. No immediate action was taken on the resolutions by the conference, however, and they were referred to a committee, after having an amendment to the effect, that, "it is desirable to arrive at some greater agreement as to the stage in education which should be reached before Greek is begun by boys intended for a classical school," tacked on to them.

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## THE GREEK ELEMENT IN ENGLISH.

THE crusade against the study of Greek, which is the fashion just now, is not always successfully met by the defenders of that study, because they either understate their own position or else miss altogether the true point of the discussion. The

study of Greek is not going to retain its place because some celebrated mediaeval and modern intellects were trained in it. It must rest its claim upon the higher ground of its humanizing influence and its unexcelled literary culture. Greek also appeals to us as having no inconsiderable share in the formation of our own language as we know and use it to-day, especially in the nomenclature and terminology of philosophy and the sciences. The value of the study on this ground is not referred to often enough, and we have never seen it more simply and deftly emphasized than in Dr. Goodell's little book entitled 'The Greek in English.'[1] As the author puts it in his preface, "The object of this book is to enable pupils to gain some real and living knowledge of that part of English which came from Greek. . . . It merely attempts to teach that minimum which even those who wish to banish the study of Greek from our schools would admit can least easily be spared; and it is written in the belief that that portion is absolutely essential to a ready command of a full English vocabulary." And this is the kernel of the book. It is written to help students to an understanding of English, in so far as English is derived mediately or immediately from Greek.

The work is arranged about a grammatical outline somewhat like that usually found in Greek primers of the old-fashioned sort, because the author believes that to be the simplest and quickest way of learning what he has to teach. The vocabulary is rather representative than complete, but it is reasonably full. We are quite ready to believe that Dr. Goodell's book will commend itself to many preparatory teachers as giving, not all that the beginner who has a college course in view wants to know, but that minimum of Greek that is a necessary part of the equipment of every well-educated man.

Dr. Goodell makes a curious slip — unless, indeed, he holds the not impossible but improbable opinion advanced by Clement of Alexandria, that 'metaphysics' is equivalent to supranatural — when he instances 'metaphysics' as one of the words into which a deeper insight is given us by a knowledge of Greek; for the prevailing opinion is that the word 'metaphysics' is a conglomerate used by Andronicus of Rhodes to denote that portion of Aristotle's writings which came after the treatise on physics in his arrangement (τὰ μετὰ τὰ φυσικά). Therefore the fact that metaphysics means ontology, the science of being, is purely accidental; it might just as well have come to mean ethics or psychology; and a knowledge of Greek, while it explains the genesis of the word, can hardly be said to give us a 'lively sense of its exact meaning.'

[1] *The Greek in English.* By THOMAS D. GOODELL, Ph.D. New York, Holt. 16°.

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## *ROSENKRANZ'S PHILOSOPHY OF EDUCATION.*

THE influence of Professor Rosenkranz on the educational thought of Germany has been very great. Born early in the century, he was a university student at a period of great philosophical and pedagogical activity. Fichte, Schelling, Hegel, and Schleiermacher were then the great leaders of German thought, and Rosenkranz came under the personal influence of the two latter. While yet a very young man, — he was twenty-eight years of age at the time, — he entered upon his long tenure of the chair of philosophy at Königsberg in succession to Kant and Herbart. The work of which the book before us is a translation was published in 1848, under the title 'Paedagogik als system.' It may be said to have raised pedagogical discussion in Germany from the petty details of kindergarten and administration to the high plane of philosophy. The work has also had a wide circulation, considering its character, in this country, for it was originally translated, some fifteen years ago, for the *Journal of speculative philosophy*, and, in adition to its circulation in that form, two thousand copies of a reprint failed to meet the demand for it. For the present and second edition, which Dr. William T. Harris publishes as the first volume in the International education series, edited by him, the translation has been revised and popularized, and accompanied with a full commentary and analysis, prepared by Dr. Harris himself. These latter are so elaborate that they unquestionably veil to a certain extent Rosenkranz's own work, but just as unquestionably do they add to the value of the book for teachers.

The translation of the title by 'philosophy of education' is a happy one, for it sets the book before American readers in its true light. It tells them in a word that there is a science of education, and that that science claims a place in the philosophical encyclopaedia in the closest connection with psychology and ethics. For pedogogics may be best described as psychology and ethics applied. The title indicates, also, the stand-point and method of the book, for, as Dr. Harris says in his preface, to earn this title, "a work must not only be systematic, but it must bring all its details to the test of the highest principle of philosophy."

It must be premised that Rosenkranz's philosophy, and hence this theory of education, is

*The philosophy of education.* By JOHANN KARL FRIEDRICH ROSENKRANZ. Translated by ANNA C. BRACKETT. New York, Appleton. 12°.

strongly Hegelian in form and statement, and hence abounds in the eccentricities and metaphysical peculiarities of that great thinker. But to our mind, this does not impair the usefulness and timeliness of the book, for whatever Hegel's exaggerations may have been, and despite the fact that his philosophy is on the wane, he seized hold on a great number of spiritual truths, and formulated them as they had never been formulated before.

The key-note of Rosenkranz's pedagogical philosophy is, that, "man's true nature is not found in him at birth, but has to be developed by his activity; his true nature is his ideal, which he may actualize by education."

The book is divided into three parts. The first considers the idea of education in general, its nature, form, and limits. The second part treats of the special elements of education, the physical, the intellectual, and the practical (in the sense of will-education), and discusses the various stages of the process of education and the problems presented by them. The third is given over to particular systems of education, and is a short history of educational theories.

Rosenkranz strikes a true note when he puts pedagogics on a psychological basis, "the nature of education is determined by the nature of mind" (p. 19), "the general form of education is determined by the nature of the mind" (p. 26), and *passim*. The limits of education are three. The first is the subjective limit, and is found in the individuality of the pupil. "Whatever does not exist in this individuality as a possibility cannot be developed from it. Education can only lead and assist: it can not create" (p. 47). The second limit is the objective one, and lies in the means which can be appropriated for education. "That a talent for a certain culture shall be present, is certainly the first thing; but the cultivation of this talent is the second, and no less necessary. But how much cultivation can be given to it, extensively and intensively, depends upon the means used, and these again are conditioned by the material resources of the family to which one belongs. The greater and more valuable the means of culture which are found in a family, the greater is the immediate advantage which the culture of each one has at the start" (p. 48). The third limit of education, Rosenkranz calls the absolute limit. And this is defined as, "the time when the youth has apprehended the problems which he has to solve, has learned to know the means at his disposal, and has acquired a certain facility in using them. . . . To treat the youth, after he has passed this point of time, still as a youth, contradicts the very idea of education, which idea finds its fulfilment in the attainment of this state of maturity by the pupil" (p. 49). After this limit is reached, self-education supplants instruction by teachers, and the ideal to be had in view, and the methods to be followed, must have been implanted during the antecedent period.

It would unduly tax our space, and it is not necessary, to select for emphasis the many valuable and suggestive points in Rosenkranz's treatment of specific educational subjects. They will appeal at once to every educator who reads the book. But some specially pregnant passages may be quoted. "*Mens sana in corpore sano* is correct as a pedagogical maxim, but faults in the judgment of individual cases; because it is possible, on the one hand, to have a healthy mind in an unhealthy body, and, on the other hand, an unhealthy mind in a healthy body. Nevertheless, to strive after the harmony of soul and body, is the material condition of all normal activity. The development of intelligence presupposes physical health" (p. 68). "What we learn through books forms a contrast to what we learn through living. Life *forces* upon us its wisdom; the book, on the contrary, is entirely passive. . . . If we are indebted to life for our perceptions, we must chiefly thank books for our understanding of our perceptions. We call book-instruction 'dead' when it lacks, for the exposition which it gives, a foundation in illustration addressed to sense-perception, or when we do not add to the printed description the perceptions which it implies; and these two are quite different" (p. 121). "The course of study must be arranged so as to avoid two extremes: on the one hand, it has to keep in view the special aim of the school, and, according to this, it tends to contract itself. But, on the other hand, it must consider the relative dependence of one specialty upon other specialties and upon general culture. It must leave the transition free, and in this it tends to expand itself" (p. 133). "Social culture contains the formal phase, moral culture the real phase, of the practical mind. Conscience forms the transition to religious culture. In its universal and necessary nature, it reveals the absolute authority of spirit. The individual discerns, in the depths of his own consciousness, commands possessing universality and necessity to which he has to subject himself. They appear to him as the voice of God. Religion makes its appearance as soon as the individual distinguishes the Absolute from himself, as a personal subject existing for and by Himself, and therefore for him. The atheist remains at the stage of insight into the absoluteness of the logical and physical, aesthetic and practical, categories. He may, therefore, be perfectly moral. But he lacks religion,

though he loves to characterize his uprightness by this name, and to transfer the dogmatic definitions of positive religion into the ethical sphere" (p. 158). "Education has to prepare man for religion in the following respects: 1°, it gives him the conception of it; 2°, it endeavors to have this conception realized in his life; 3°, it subordinates the theoretical and practical process in adapting him to a special stand-point of religious culture" (p. 159).

In treating the history of educational theories, Rosenkranz distinguishes three types, the national, the theocratic, and the humanitarian. "The first works after the manner of nature, since it educates the individual as a type of his race" (p. 188). The theocratic system resembles the national, but it makes the ground of the uniformity of the individuals not merely the natural element in common, but it takes as the common interest the result of spiritual unity, which neglects nature and concentrates itself upon the events of its own history. "The theocratic system educates the individual as the servant of God" (p. 188). The third system "emancipates the individual, and elevates him to the enjoyment of freedom as his essence; educates him within national limits which no longer separate but unite; and, in the consciousness that each, without any kind of mediation, has a direct relation to God, makes of him a man who knows himself to be a member of the spiritual world of humanity" (p. 188).

It is almost impossible to exaggerate the importance of this treatment of education for teachers and the American public generally. Too often given over to shallow theory, false practice, and superficial sentimentalism, a broad, deep, and philosophic treatment of education will be for them both a stimulant and a tonic. To those used to the trashy educational journals and books now so current among us, Rosenkranz will undoubtedly be difficult reading. But he needs more than reading; he must be studied. The certain effect of the study will be to develop the intellectual and moral insight of the student, and, where a vicious activity and bold experimentalism exist, to substitute for them a true practice and a sound philosophy.

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The Swedish society of anthropology and geography has published a collection of drawings made by C. Bovallius during his stay in Nicaragua in 1882–83. Though zoölogical researches were the main object of the author's journeys, he availed himself of the opportunity to make some archeological collections. He went over the same ground as Squier did more than thirty years ago, but he found many new relics of the ancient inhabitants. He publishes drawings of many statues hitherto unknown, and as he does not consider some of Squier's reproductions sufficiently exact, he gives his own copies of the originals. The volume contains 41 plates, and a map of Nicaragua and Costa Rica. In the plates we find represented objects from Zapatera, a small island in the lake of Nicaragua, rock carvings from Ceiba, a small island near the former, and ceramic objects from Ometepic, Zapatera, and Ceiba. The author gives a brief introduction on the tribes of Nicaragua, and descriptive text to accompany the plates.

— The last number of the *Quarterly journal of microscopical science* (vol. xxvii. part ii. p. 285) contains a very severe criticism of Dr. Patten's paper on the 'Eyes of mollusks and arthropods.' The review is unsigned, but was presumably, we venture to say, written by the editor of the journal, Professor Lankester, who is certainly a competent authority to pass judgment. Fault is not found with the new observations recorded by Dr. Patten: on the contrary, they are accepted as sincere and valuable. The full severity of the condemnation is turned upon the theories and generalizations of the author, and upon his criticisms of preceding investigators. The accusation is brought that the author has promulgated many false views and crude theories, such as would have appeared possible only to an ignorant thinker; further, that he has recklessly set aside by simple denials many statements of esteemed observers, on the ground that they were irreconcilable with his own conclusions; finally, that he used a tone in his criticisms which is unpardonable in a scientific discussion under any circumstances. It is very rare that such heavy charges are made against any scientific writer. Their extreme gravity renders it specially incumbent upon us to reserve our judgment until Dr. Patten shall have made his answer. As we have directed attention to the accusation, we shall be glad to give due attention also to the defence.

— As part of the scheme of the late Colonel Roudaire and M. de Lesseps to form an inland 'African sea,' it was suggested that an attempt be made to obtain water from artesian wells, with the idea of cultivating the sourrounding country and using the rents for building the canal intended to connect the Mediterranean with the proposed sea. The first well was started in May, 1885. Water was found at a depth of 295 feet, and in June, 1886, was running at the rate of 2,340 gallons per minute. As a consequence, the banks of the Melah River (Tunis), which a very few months ago were deserts, are now populated and productive.

## Contents of foreign educational periodicals.

*Central-organ für die Interessen des Realschulwesens*, December issues. — Zweikämpfe zwischen Sprichwörtern, Dr. Friedrich — Womit muss der englische Unterricht in Deutschland beginnen? Dr. Ernst Friedrich. — Die Einheitsschule. — Nachrichten, Bücher. — Anzeigen, u.s.w.

*Zeitschrift für das Realschulwesen.* — Die Bezeichnung der Aussprache in den englischen Lehrbüchern, Prof. J. Resch. — Ueber das sphärische Dreieck, Eduard Grohmann. — Schulnachrichten, Recensionen, u.s.w.

*Revue internationale de l'enseignement*, Jan. 15. — La question des universités françaises, Ernest Lavisse. — La réforme des études juridiques en Allemagne, Georges Blondel. — Histoire de la civilisation dans le sud-ouest de la France, Camille Julian. — Un professeur français; M. Belot, M. Bayet. — Chronique, correspondance, nouvelles et informations, bibliographie, etc.

*Revue de Géographie*, December. Des rapports entre les populations et le climat sur les bords européens de la Méditerranée, M. Vidal-Lablache. — La société de topographie de France et l'école de géographie, M. Bardoux. — De la constitution de la science géographique, M. L. Drapeyron. — De la topographie appliquée à la colonisation de la côte occidentale d'Afrique, M. Ch. Borer. — Le mouvement géographique, M. Delavau.

*Revue de l'enseignement secondaire*, Jan. 1. — Revue de quinzaine, M. Zevort. — Les essais de Montaigne; notre bibliographie, M. Gustave Allais. — Agrégation de l'enseignement spécial en 1887; Bibliographie spéciale. — L'anglais, langue complémentaire de l'allemand, M. G. S.

*Revista de la association de Maestros*, October (Buenos Aires). — Horarios escolares (carta de Berra.) — Reformas escolares, conferencia por el profesor normal Pablo A. Pizzurno. — Las reuniones pedagógicas y los horarios. — Una estátua a Pestalozzi. — Parásitos de la educacion (artículo dedicado á todos los superintendentes). — Indicationes útiles á los maestros.

*Rivista pedagogica italiana*, Dec. 15. — Un' inchiesta psicologica sull' infanzia, E. Mortelli — Militarizzazione o semi-militarizzamento dei convitti nazionali, A. Gelmini. — I lavoro manuale nella scuola popolare (continuazione e fine), C. Grimaldi. — Sul passaggio delle scuole elementari allo stato. — Poche osservazioni di un maestro elementare, A. Gnutti. — Dalle varie provincie del regno. — L'istruzione primaria in Livorno, Plinio. — Qua e la frai programmi didattici, F. Veniali. — Libri e giornali. — Intorno all' insegnamento agrario nelle scuoli rurali. — Le scienze naturali nelle scuole elementari.

*Zeitschrift für Schul-geographie*, January. — Die Verwertung deutscher Dichtung und Sage für den geographischen Unterricht, S. Gorge. — Der erdkundliche Unterricht an den höheren Mädchenschulen in Deutschland. — Winnipeg. — Repertorium der methodischen Literatur. — Reliefkarten. — Notizen, Zeitschriften, u.s.w.

## Educational articles in miscellaneous periodicals.

Alternative to socialism, the. Unsigned. *London quarterly review*, January.
Droit naturel et la science sociale, le. M. H. Joly, *Nouvelle revue*, Jan. 1.
Enseignement secondaire et les dernières réformes, l'. M. Gabriel Compayré. *La revue generale*, Jan. 1.
Faith and physical science. W. H. Mallock, *Forum*, February.
Generalizations of science, the. Prof. C. L. Morgan, *Mind*, January.
How I was educated. Andrew D. White. *Forum*, February.
Laws of habit, the. Prof. William James. *Popular science monthly*, February.
McCosh, James, the president of Princeton college, *Century magazine*, February.
Méthode expérimentale chez les anciens, la. V. Brochard. *Revue philosophique*, January.
Mouvement intellectuel, le. MM. Frary et Bourget. *Nouvelle revue*, Jan 1.
Pensée, la. A. Gautier. *Revue scientifique*, Jan 1.
Physiological selection. George J. Romanes. *Nineteenth century*, January.
Political economy in America. Dr. R. T. Ely. *North American review*, February.
Question du Latin en Allemagne, la. M. Schwiedland. *Revue scientifique*, Jan. 1.
Ranke and his method. Dr. J. H. W. Stuckenberg. *Andover review*, February.
Religious exercises in state schools. Prof. N. R. Davis. *Forum*, February.
Renan's later works. Andrew Lang. *Fortnightly review*, January.
Schools as prisons and prisons as schools. Lord Norton. *Nineteenth century*, January.
School of English literature, a. Unsigned. *Quarterly review*, January.
Science in religious education. Daniel G. Thompson *Popular science monthly*, February.
Spencer's 'Unknowable.' Unsigned. *Scottish review*, January.
University of London, the. Unsigned. *Quarterly review*, January.

## Publications received at Editor's Office, Feb. 7-12.

BASTIAN, A. Die Seele indischer und hellenischer Philosophie in den Gespenstern moderner Geisterseherei. Berlin, Weidmann. 223 p. 12°. (New York, Stechert, $2.20.)
BAUMGARTEN, P. Lehrbuch der pathologischen Mykologie. Hälfte i. Braunschweig, Bruhn. 220 p. 8°. (New York, Stechert, $2.20.)
BAUNACK, J. und T. Studien auf dem Gebiete des griechischen und der arischen Sprachen. Band i. teil 1. Leipzig, Hirzel. 218 p. 8°. (New York, Stechert, $2.20.)
BAYLEY, W. S. A summary of progress in mineralogy and petrography, in 1886. Philadelphia, Amer. nat. [40] p. 12°.
COLLITZ, H. Die neueste Sprachforschung und die Erklärung des indogermanischen Ablautes. Göttingen, Vandenhoeck & Ruprecht. 40 p 8°. (New York, Stechert, 60 cents.)
COMPAYRE, G. Eléments d'instruction morale et civique. 65th ed. Paris, Delaplane. 207 p. 16°.
—— Same. Récits, exemples, préceptes, paraboles, fables. 100th ed. Paris, Delaplane. 138 p 16°.
—— Notions élémentaires de psychologie. Paris, Delaplane. 299 p. 12°
DAHL, F. Die Nothwendigkeit der Religion, eine letzte Consequenz der darwinschen Lehre. Heidelberg, Weiss. 112 p. 8°. (New York, Stechert, 75 cents.)
DIERDERICHS, A. Unsere Selbst- und Schmelz-laute (auch die englichen) in neuem Lichte. Strassburg, Trübner. 315 p. 8°. (New York, Stechert, $1.90.)
DU BOIS-REYMOND, E. Reden von. Zweite folge. Biographie, Wissenschaft, Ansprachen. Leipzig, Veit. 589 p. 8°. (New York, Stechert, $3.30.)
ELSAS, A. Ueber die Psychophysik. Marburg, N. G. Elwert. 76 p. 8° (New York, Stechert, 75 cents.)
FREY, T. Zur Bekämpfung zweitausendjähriger Irrthümer. Leipzig, Fritsch. 84 p. 8°. (New York, Stechert, 55 cents.)
FRITZ, J. Aus antiker Weltanschauung. Hagen i. W., Risel. 433 p. 8°. (New York, Stechert, $2.60.)

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GUESSFELDT, P. In den Hochalpen. 2d ed Berlin, Allgemeiner Verein für deutsche Literatur. 349 p. 12°. (New York, Stechert, $2.20.)

HERING, E. Ueber Newton's Gesetz der Farbenmischung. Prag, Tempsky. 92 p. 8°. (New York, Stechert, 55 cents.)

HILGARD, E. W. Alkali lands, irrigation and drainage in their mutual relations. Sacramento, State. 45 p. 8°

HILGENFELD, D. A. Judenthum und Judenchristenthum, eine Nachlese zu der "Ketzergeschichte des Urchristenthums." Leipzig, Reisland. 122 p. 8° (New York, Stechert, 90 cents.)

JACOBSEN, O. Die Glycoside. Breslau, Trewendt. 174 p. 12°. (New York, Stechert, 70 cents.)

KOHL, F. G. Die Transpiration der Pflanzen und ihre Einwirkung auf die Ausbildung pflanzlicher Gewebe. Braunschweig, Bruhn. 124 p. 8°. (New York, Steckert, $3.30.)

LANGE, L. Die geschichtliche Entwickelung des Bewegungsbegriffes und ihr voraussichtliches Endergebniss. Leipzig Engelmann. 141 p. 8°. (New York, Stechert, $1.10.)

MEUSEL, E. Die Quellkraft der Rhodanate und die Quellung als Ursache fermentartiger Reaktionen. Gera, Reisewitz. 36 p. 8°. (New York, Stechert, 55 cents.)

## Calendar of Societies.

### *Philosophical society, Washington.*

*Feb.* 12.—H. A. Hazen, The sky-glows of 1883; Bailey Willis, Bay's Mountains, Tennessee; G. Brown Goode, The geographical distribution of scientific men and institutions in the United States.

### *Chemical society, Washington.*

*Feb.* 10.—R. B. Riggs and J. E. Whitfield, on some new meteorites; C. A. Crampton, Analysis of sugar-cane and beet-juices, etc.

### *Torrey botanical club, New York.*

*Feb.* 8.—F. J. H. Merrill, Exhibition of plants collected at Tampa and Key West, Fla., and Collin and Robertson counties, Tex., in 1886.

### *Boston scientific society.*

*Feb.* 8.—Some errors in relation to the art of the mound-builders; A splendid meteor; Furs out of season; S. Garman, On Massachusetts snakes.

### *Sedalia natural history society.*

*Nov.* 8.—G. C. Broadhead, The geology of western Missouri.

*Dec.* 13.—H. M. Specking, Natural history and the use of the microscope.

*Jan.* 10, 1887.—F. A. Sampson exhibited a fine skull of the Coryphodon; Mrs. C. Demuth, Reptiles,

*Election of officers.*—President, Dr. J. W. Trader; vice-president, H. C. Sinnett; corresponding secretary, F. A. Sampson; recording secretary, J. W. Walker.

### *Missouri university club, Columbia.*

*Feb.* 7.—R. E. Call, The present status of the doctrine of descent.

# SCIENCE.

FRIDAY, FEBRUARY 25, 1887.

## *COMMENT AND CRITICISM.*

THE FULL DISCUSSION, from both the economic and the commercial standpoints, that the interstate commerce bill has received in the United States, brought out the many points of contact between the railway problem as it presents itself to this and to other nations. We have had forced home upon us the conviction, that while local conditions may vary, yet the question at issue is substantially the same, whether it presents itself here or in Great Britain or Germany. For this reason the observations concerning the railways and transportation made by the British commission on the depression of trade — of whose report we present an account elsewhere — will be of interest to those who have studied the railway problem in the United States. The report of the majority of the commission finds, that, among all the causes which are said to have aggravated the prevailing depression, none has been so persistently put forward as the difficulties connected with the transportation of goods. The complaints made before the commission under this head are of three classes : "1°, that the railway companies regulate their charges so as to favor one district, or place, or trade, at the expense of another, and the importer of foreign goods at the expense of the home producer; 2°, that the cost of transit in this country is excessive as compared with the charges made for similar services in other countries, and that consequently our home trade is being crippled or destroyed to the advantage of our foreign competitors, who are able to place their goods in our markets at a less expense than the home producers, who carry on their operations at a much less distance; 3°, it is contended that if the water communications of the country were properly developed, an effective competition would thus be established which would regulate the monopoly now possessed by the railways."

The report states, that, so far as the first of these points goes, even if proved, it could only account for a local and not for any such wide-spread depression as is found to prevail; for what one trade or locality loses, another must gain. Furthermore, if companies be compelled to withdraw the advantages complained of in the case of imported goods, what assurance is there that it may not be found necessary to follow the same treatment with goods intended for export, and, in fact, to abolish all through rates? In regard to the second point, it is admitted that railway transportation is cheaper on the continent than in Great Britain, because of the lower initial cost of the continental railways, and because the longer distances to be traversed there operate to reduce the rate per mile. But it is contended that the present rates — which have parliamentary sanction — only afford an average return of about four per cent on the capital invested, and consequently cannot be reduced. The commission adds that it is not so much the cheapness of land transportation on the continent that is felt, but the cheapness of the sea transportation between the continent and Great Britain : for the complaints arise principally from the inland towns which have no transport save that afforded by the railways, and consequently are at a disadvantage as compared with sea-coast towns. As this advantage in favor of the latter is perfectly natural, the commission finds no justification for interfering with it. On the third point both complainants and commission agree, and the latter recommends the adoption of measures which will permit of the free development of canals wherever they are likely to be useful and prevent their being controlled by the railway companies, as appears to be the case in many parts of the country.

THE BILL WHICH has been introduced in the assembly of the state of New York, entitled "An act to regulate the licensing and registration of physicians and surgeons, and to codify the medical laws of the state of New York," is one which should meet with the hearty support of the medical profession, and receive the vote of every member of the legislature. That legislative action is necessary to codify the laws relating to medical practice is evident, when it is considered that there are at the present time fourteen or more such laws in force, some of them having been enacted as

long ago as 1806. The act now before the legislature repeals many of these laws entirely as well as the inconsistent and useless sections of the others. We have not had time to compare the proposed law with those which it will repeal, but as the act has been prepared by the counsel of the New York county medical society, who has probably had as much experience in these matters in the courts as any of the lawyers, we presume the repealing clause is right and proper. We are glad to see that provision is also made by which the question of registration will be settled, so that the practice of county clerks throughout the state will be uniform. It will hereafter be necessary for a physician to register in person in but one county, after which registration he will receive a certificate of registration from the county clerk. If he desires to remove his practice to another county, or to engage in practice or open an office therein, he may present his certificate in person to the clerk of that county, or mail it to him by registered letter. On this certificate the clerk will indorse, 'registered also in —— county,' and the physician is then qualified to practise therein.

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Another section of the law which is most equitable and just, and one which will remove all cause for doubtful interpretation of existing laws, is as follows: "Nothing in this act shall be construed to punish commissioned medical officers serving in the army or navy of the United States, or in the U. S. marine hospital service, while so commissioned, or any one while actually serving as a member of the resident medical staff of any legally incorporated hospital, or any legally qualified and registered dentist exclusively engaged in practising the art of dentistry, or any lawfully qualified physicians and surgeons residing in other states or counties meeting registered physicians and surgeons of this state in consultation, or any physician or surgeon residing on the border of a neighboring state, and duly authorized under the laws thereof to practise physic or surgery therein, whose practice extends into the limits of this state, providing that such practitioner shall not open an office or appoint a place to meet patients or receive calls within the limits of the state of New York; or physicians duly registered in one county of this state called to attend isolated cases in another county, but not residing or habitually practising therein." The other provisions of the law which are intended to punish all those who fraudulently practise medicine, are also worthy of commendation. We sincerely trust that the whole bill will promptly pass both houses of the legislature and receive the signature of the governor.

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CAPT. A. W. GREELY'S appointment as chief signal-officer with rank of brigadier-general is a well-merited promotion. It is also a compromise with those who have been advocating the separation of the service from the army; for, while the new chief is an army officer, he is also a man of scientific attainments and experience, and it was for the purpose of securing a person with the latter qualifications that the change was advocated. The appointment is also applauded by the President's friends as being in strict line of civil-service reform, as Captain Greely was next in rank in the bureau to General Hazen, and had worked long enough with him to understand fully the methods of the service. The general impression seems to be that the senate will confirm the nomination.

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## *THE LATE ERUPTION FROM KILAUEA.*

BECAUSE of the increased numbers of tourists, better facilities are now offered for visiting Kilauea. Instead of the arduous equestrian journey of thirty miles from Hilo, over rough lava, often in the midst of rain, the traveller can now disembark from the Kinau — the best of the inter-island steamers — at Keauhou on the dry side of Hawaii, and reach the Volcano House by a new road, only eighteen miles long, and that mostly in a carriage. Arrangements have been perfected by which the round trip can be taken from Honolulu in six days' time, allowing two nights and one and a half days at the caldera, and at a cost of sixty dollars.

The first recorded eruption from Kilauea was in 1789, when a troop of native soldiers were suffocated. The first scientific accounts are those of Ellis in 1823, and of the U.S. exploring expedition in 1840, as given by Commodore Wilkes and Prof. J. D. Dana. Since then the more notable changes have been recorded by Dr. Titus Coan in the columns of the *American journal of science*. In 1882 Capt. C. E. Dutton explored Kilauea and the Hawaiian Islands generally, presenting in the 'Fourth annual report of the U.S. geological survey' the best description of the volcanic phenomena of that part of the world that has yet appeared. In the following year, and also during the past summer, the writer went over the same ground.

Immediately after the disappearance of the lava in Kilauea in March last, Prof. W. D. Alexander, chief of the trigonometrical survey of the Hawaiian Islands, directed his assistants to make a plan of the disturbed region; and by his kindness we are permitted to present it to the readers of *Science*. The triangulation and details of the sunken portion are from the surveys of J. S.


Emerson; the general outlines are from W. T. Brigham's survey of 1865, while the map was drawn by F. S. Dodge. The descriptive lettering is mostly taken from Brigham, with a few additions and improvements: for instance, the names of the small adjoining craters are altered to correspond with Hawaiian usage. The 'Kilauea Iki' of Brigham is changed to 'Keana Kakoi,' and 'Poli-o-keawe' is changed to 'Kilauea Iki.' The designation 'Poli-o-keawe' is applied to the shelf between the large and small calderas. Captain Dutton copied these errors of Brigham into his report.

Commodore Wilkes prepared a map of Kilauea, delineating the main topographical features, and especially showing the 'black ledge,'—a shelf of desiccated lava from 600 to 2,000 feet in width, and about 660 feet below Uwakahuna, the highest point in the rim on the western side. It encircles a lower pit, 12,000 feet long, 3,000 feet wide, and 384 feet deep, which represents the dimensions of the block of melted lava that broke out twenty-seven miles distant, and then flowed twelve miles to the sea at Nanawali. The black ledge was still discernible in 1865, but has not been mentioned for the past ten years. The southern end of the deep pit represents the centre of activity, called 'Halema'uma'u.' From time to time tem-

porary lakes of fire appear on all sides, but Halema'uma'u remains essentially constant. This is a real crater, while Captain Dutton has well suggested the name of 'caldera' for the entire depression.

The entire pit was never fuller than on the evening of March 6, 1886. The lava that for nine years, or since the last previous important discharge (1877), had been accumulating and pouring over the floor from Halema'uma'u and New Lake, till it attained the altitude of 3,719 feet above the sea-level. The floor was convex, and 160 feet higher at the lakes than at the northern edge, while the general level averaged from 150 to 200 feet above the black ledge of Wilkes. To the south the lava had risen upon the old sulphur-banks, nearly covering them, while leaving a long narrow promontory scarcely a dozen feet above the general level. Late in the evening there commenced a series of earthquakes, so severe as to alarm J. H. Maby, the landlord of the Volcano House, and his household. Up to 8 A.M. of the following day, forty-three shocks were noted, some of them probably occasioned by the falling of large masses of rock. Shortly after midnight the lava disappeared through a subterranean channel, filling up some vacant chamber, probably, since it did not discharge anywhere at the surface, nor was there any oceanic disturbance within easy distance of the island. The thickness of the molten column that disappeared proves to be 570 feet, without estimating the additional distance to the unknown reservoir beneath the rough fallen fragments.

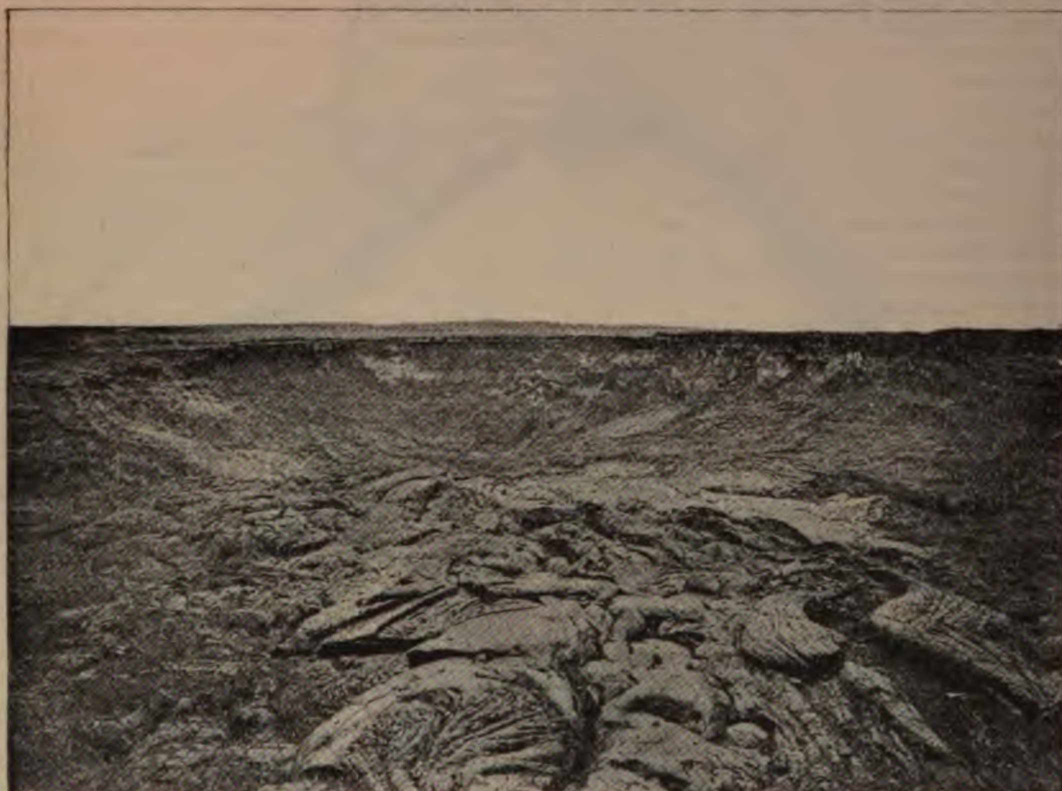

Fig. 1.—Cavity once occupied by the New Lake.

The map gives a correct delineation of the sunken area. The main depression is roughly triangular, with sides about 3,350 feet long, forming an area less than half a mile square. In extent it is not very unlike Kilauea Iki, though the basin carries less cubical content. To the east of the principal depression is the space left by New Lake and Little Beggar, the smaller temporary craters. The average depth of this circular segment is 165 feet; the length, 1,700 feet; width, 250 to 650 feet. It is a sort of shelf or terrace adjoining the greater depression. The triangular pit

is very irregular, some portions of it equalling the New Lake terrace in altitude, while the deepest part is in the centre. The walls of the depression may now be called the 'black-ledge;' and their limited dimensions, as compared with the greater pit formed in 1840, will illustrate the littleness of the late discharge. Like the last, the next eruption may be expected after the new pit has been refilled.

The accompanying illustrations show the sunken from its lowest point. The greatest depth exhibited is 570 feet.

Besides the formation of this pit, there were produced several large cracks in the neighborhood, — one on the Poli-o-keawe, at the sulphur-banks near the Volcano House; and two on the way to Keauhou, two miles distant.

Quietness and darkness reigned in this pit till the fourth day of June. Four days later we visited it, and found upon the east side of the

FIG. 2. — HALEMA'UMA'U AFTER THE DISAPPEARANCE OF LAVA IN APRIL, 1886.

region. The first (fig. 1) shows the space occupied by New Lake. The steep wall was the edge of the molten lava, and the depth 165 feet. In both views the precipitous walls constitute the new black ledge.

The second (fig. 2) shows the pit of Halema'uma'u. The lava reached very nearly to the top of the cliff before the eruption. The general level of the depression is similar to that of the bottom of New Lake, and the central pit is well shown with the steam and sulphurous gases rising deepest pit a hole about forty feet across, descending at an angle of eighty or eighty-five degrees to a lake of fire. Great volumes of steam and sulphur vapor poured out of this orifice, whose walls were lined with sublimed sulphur and Pele's hair. As the opening lay in the midst of loose blocks of lava and widened out downwards, it was dangerous to stand near the edge; but the swashing of the liquid was distinctly audible, and stones thrown down were heard to splash into the liquid. The depth to the lava was probably about two

hundred feet. To the northward about two hundred feet was a copious discharge of corrosive vapors, which increased in strength in the course of the following week. At night the fire could be seen above the pit, just as at our earlier visits. It was evident the fire had returned to Kilauea; and the drooping spirits of the proprietors, who had made extensive preparations for the entertainment of tourists, began to revive. On the 25th of June a still larger vent opened upon the west side of the deep pit, or rather two of them. Two lakes of fire formed, divided by a very narrow ridge, early at the level of the deepest part of the pit (at least 800 feet below the Volcano House), and having a length of 700 feet and a width of 400 feet. About the same time the lava flowed out of the small opening of June 4, and is filling up the deep pit. Professor Van Slyke of Oahu college reports that the pit was entirely filled up at the end of July, and that a conical mound is forming above it. This will probably develop into a second Halema'uma'u, occupying, as it does, exactly the same place as the old one. All the discharging vents are situated within the limits of the sunken area of the map.

FIG. 3.—THE NEW HALEMÀ'UMA'U, AS SEEN EARLY IN OCTOBER, 1886.

Advantage was taken of our visit to explore the southern part of the caldera. Standing at Keana Kakoi, one sees to the south-west and south a stretch of volcanic sand and *débris* fully equal in dimensions to Kilauea itself. On examining more closely the material called 'sandstone' and 'gravel' upon the map, it was seen to consist of material ejected from the volcano, and numerous lava-bombs were picked up. Ashes also cover the country to the south and south-west over the Kau desert for several miles. The conclusion is therefore forced upon us that the earlier eruptions varied in character from any thing that has been observed during the last half-century. Ashes, sand, and stones were thrown to a distance of several miles from the volcano; so that the Vesuvian type of action has been sometimes exemplified here.[1] It was in the neighborhood of the Keana Kakoi that the army was suffocated in 1789, perhaps by the very eruption whose *débris* are now strewed over the surface, and it may have come possibly from Keana itself.

It is not generally known that in 1868 the lava of Kilauea discharged from a vent in the Kau desert seven or eight miles distant. It has been claimed by some that the flow at Kahuku in that

[1] Observations made in the sugar-plantation districts of all the islands suggest that the subsoil is probably derived from these aerial discharges rather than from the decompostion of lava or from a deposit beneath the ocean, as suggested by Captain Dutton.

year came from Kilauea. The best authorities, like Dutton, agree that the Kahuku flow came from Mauna Loa, while Kilauea overflowed in the Kau desert. The area of the flow is only about a quarter of a mile in length and breadth.

It is worthy of note that after the eruptions of 1823, 1840, and 1886, the returning lava has stood at nearly the same level. That of 1823, described by Ellis, is estimated by Dutton to have been 400 feet lower than at the time of his visit. Reducing the figures to a uniform standard reference to the sea-level, the altitude in 1823 was 3,177 feet; in 1840, 3,170 feet; in 1886, 3,140 feet, or the lowest point. In 1882 the level of New Lake was estimated at 3,577 feet. The highest level of March 6 was at 3,719 feet. It appears, therefore, that there has been no essential change in the normal natural level of the molten lava for the past sixty-five years.

By advices sent as late as the middle of October, it appears that the central cone has risen 700 or 800 feet above the lowest level of the pit, and it is still rising. Small streams of lava issue, play around, and harden between the central cone and the walls of the pit; so that the old Halema'uma'u is being restored (fig. 3).

During the months of September and October Professor Alexander employed parties to make a further survey and map of the great caldera. The result is given in the annexed map after the sur-


HALEMA'UMA'U IN OCTOBER, 1886.

veys of F. S. Dodge. The earlier map of Emerson was based upon the sketch of W. T. Brigham, made in 1866, and any general changes of outline observed are due to the greater precision of Dodge's survey. One observes differences in the northern wall, the straightening of the cliff in front of Kilauea-Iki, the more satisfactory representation of the two side-craters, and the location of the promontory at the old sulphur-beds. Halema'uma'u itself shows changes between these two latest maps. Instead of the deep pit in the centres 900 feet below the Volcano House, there is a circular ridge nearly 600 feet above that lowest point. The lava which commenced to flow June 4 has continued to discharge ever since, and has now built up this crater. There is a sort of moat between the crater and the black ledge surrounding it as well as the central pit within. There is represented also an interesting patch of Aa to the north of Halema'uma'u.

C. H. HITCHCOCK.

## PARIS LETTER.

IN a paper recently read before the Biological society of Paris, Dr. Debierre gave the results of researches concerning the physical superiority of the right side of the human body. Since the experiments of Harting, Sappey, Jobert, Concet, Milne-Edwards, and others, it has been generally accepted that in right-handed persons the right side is larger, longer, and heavier than the left side. To ascertain whether this disparity exists in early life, or is afterwards developed by education, Dr. Debierre experimented upon the dead bodies of young children, and found that, where education and practice had not interfered, there was no difference in size or weight between the right and left limbs. This is well, so far as it goes, but there must be some reason for the superior development by education of the right side. Even if we admit that education is the only reason for this superiority, we must believe that some circumstances in the foetal development, or in the conditions governing the nervous centres, are favorable to it, as it is so general, unless we believe that the first man was by special design created right-handed. But this belief I think no naturalist would accept.

As a consequence of the troubled international relations on our continent, — a state of affairs prejudicial to thought and business alike, and which will end some day in a tremendous crash and most foolish and unprofitable waste of human energy and life, — chemists are busily engaged in seeking improved methods of destruction. In France a new explosive has been devised, said to be as much superior to nitro-glycerine as the latter is to common gunpowder. It is called 'melinite,' and its explosive force is to that of gunpowder as 100 to 5. Its destructive effects are fearful, inasmuch as bombs charged with it do not explode immediately upon striking a wall, or similar resisting surface, the explosion taking place some little time after penetration. This new war material is the invention of MM. Locard and Hirondard of Bourges, to whom the minister of war has given an order for 200,000 bombs charged with

it. In Germany a new shell has been devised, on principles made known some years ago by M. Turpin, a French inventor. In this new projectile two substances, one of which acts as igniter and the other as combustible, are placed close to each other, but not in contact. The igniter is contained in a glass bottle, which is broken by the shock caused by the striking of the shell, thereby permitting the two substances to come into contact and causing the explosion at the desired moment. Neither of these substances is dangerous in itself, and either may be handled separately without risk. The projectiles are not charged with the igniting substance until they are to be used. A third new explosive has been invented in Berlin. It is called 'roburite,' and has given good results, but it is dangerous to handle, and is said to deteriorate more or less rapidly after manufacture.

Miss Klumpke, whom I mentioned in my last letter as having competed for the *internat* of the Paris hospitals, has been successful, passing as number 16, the whole number of competitors being about 600. She is an American, from San Francisco. Another American lady has been appointed *interne provisoire*, to be on duty only in case supplementary *internes* are necessary and for one year instead of four.

As I stated in my last letter, female students are pretty numerous in Paris. Most of them are Russians, generally very poor, so they club together in small sets, — many of them have brothers or husbands with them who are students also, — and put their resources into a common fund. One room is used as dormitory, another as study, etc., and a single cook does for all, — phalansterism as proposed by Fourier. They work hard, and the life of all, men and women, is very respectable in every way.

At a recent meeting of the Biological society a paper on paralytic rabies in man was read by M. Gamaleïa, a physician of Odessa, and director of the Russian antirabic inoculation institution in that city. One of M. Peter's main assertions in his discussion with Pasteur is that paralytic symptoms are met with only in rabbits and in cases of experimental hydrophobia; genuine hydrophobia, according to M. Peter, being always convulsive. M. Gamaleïa shows that such is not the case, and gives the records of sixteen cases of paralytic rabies witnessed by himself. The symptoms induced by this sort of hydrophobia are as follows: ataxy, paresis, and paralysis of the legs and arms, sensibility being unimpared (at the outset, at least); lumbar pains, shooting from the back forwards; paralysis of the abdominal and rectal muscles. The paralysis gains ground, invading the neck, tongue, and face, and finally asphyxia sets in. Among the causes which seem to co-operate in inducing the paralytic form of rabies, M. Gamaleïa notes especially the penetration of a large quantity of virus. This certainly was the case with the patients who died after submitting to Pasteur's intensive method.

The government report on fisheries for 1885 has just been published. The fishing vessels of all descriptions number 23,877, manned by 85 915 men. There are also 57,088 fishermen who fish along shore. The total weight of fish taken was 187,000,000 kilograms, valued at 92,736,585 francs. There has been a complaint for some years past of the increasing scarcity of sardines. These fish seem to stop in the neighborhood of the Spanish and Portuguese coasts, not going much farther north. The deaths among the fishermen for the year mentioned number 363, leaving 212 widows and 416 orphans. Were it not for the high freights charged by the railroads for the transportation of fish, the fisheries would be much more prosperous than they are, the high freights preventing the development of new markets. This is especially the case with oysters. In Brittany, for instance, oysters are so very abundant that at present they sell at nine francs per thousand, while in Paris they sell at fifty francs, owing to the high price of transportation and the local duty.

The telephone experiments which recently took place between Paris and Brussels were very satisfactory. The line was opened to the public some days ago, when a lively chat took place between the invited guests of the minister of posts and telegraphs, and those of the post-director of Brussels. Within the city the wire is inclosed in wooden tubes enveloped by a leaden tube. For the rest of the distance it is an ordinary aerial line, the wire being of siliceous bronze, — the same wire being used for both telegraphic and telephonic purposes. The tariff for five minutes' conversation between Paris and Brussels is three francs.

Some days ago Professor Alglave, the able director of the International scientific series, in France, delivered an interesting public lecture on alchoholism. He stated that of one hundred insane persons, forty had been intemperate; that fully one-half our criminals had been in the habit of drinking to excess, and that delirium tremens kills 2,200 persons every year. The reason for the increase in the death rate of alcoholic patients is not that there are a greater number of victims, but that alcoholic liquors are much more poisonous than formerly, owing to their poorer quality and the addition to them of inferior alcohol made from rice, potatoes, corn, beets, etc. Of 1,872,000

hectolitres of alcohol consumed annually, scarcely 25,000 hectolitres are pure ethylic alcohol made from grapes, — and other alcohols are real poisons, as may easily be shown. To kill an animal it requires about 7 grams of ethylic alcohol per kilogram of the animal's weight, while of amylic alcohol it requires only about 1 gram. To produce death in a man of 80 kilograms weight, it would require 620 grams of the pure alcohol, but only 88 of the other. Alcoholism is therefore produced seven times sooner with the latter than with the former.

It is now fifty years since the first railroad was built in France, and the fiftieth anniversary is being celebrated in the Bois de Vincennes. But the railroad companies prefer to wait and celebrate this anniversary during the exhibition of 1889, so it is likely that the present celebration will be a failure.

At a recent meeting of the Academy of sciences, M. Hayem of the medical school read a paper on the phenomena noticed in the head of an animal after decapitation, with or without transfusion of fresh blood. As soon as the head is separated from the body the eyes move convulsively, and a look of wonder and anxiety is noticeable on the face. The jaws separate with force, and the tongue seems to be in a tetanic state. There appears to be some consciousness of what is going on, but this does not last more than three or four seconds. The eyes then shrink into the head, and some spasmodic efforts at breathing are made; the nostrils expand, the mouth opens, the tongue is retracted towards the fauces. This respiratory effort is repeated three or four times, but the senses seem to be inactive, and the will is lost. These phenomena last one or at most two minutes, and the head then becomes utterly inert. If preparations have previously been made so that the head after separation continues to receive a fresh supply of blood, the voluntary manifestations persist as long as the blood supply is sufficient, — that is, for half an hour or so. When a blood-supply is furnished after the head has become entirely motionless, the phenomena are as follows: some contractions, very week and feeble, take place, especially in the muscles of the lips; then some respiratory efforts; reflex actions of the eye, first weak, then well marked, but the eyelids remain drooping; the senses are quite asleep, and no will is manifested. Of course, the longer the period between decapitation and the restoration of blood supply, the longer the time before these phenomena are apparent. In conclusion, it may be assumed that decapitation does not produce instantaneous death. Conscious life and feeling continue for a few seconds. Whether or not pain is felt during this brief period cannot be ascertained, most likely not, owing to the rapid death of nervous elements, with which alone sensation is concerned.

M. J. Schoenfeld has recently devised an ingenious method of written communication between blind persons and those who can see. Instead of printing the letter *p*, for instance, in relief as in other systems, a combination of pointed projections or stops, — as we will call them for convenience, — is used. These stops are of conical form, such as may be produced upon one side of a piece of paper by pressing lightly upon the other side with a sharpely pointed pencil. The number of stops used is six, arranged in two parallel columns of three each, thus ⠿, and numbered consecutively from one to six, 1, 2, and 3 running down the first column, and 4, 5, and 6 down the second. In this system the letter *o* is represented thus ⠕, and *r* thus ⠗, — and as these signs are in relief they may be read as well by the eye as by the touch. The letter *o*, as we perceive, is a combination of the stops numbered 1, 3, and 5, — 2, 4, and 6 being omitted. The letter *r* is composed of the stops numbered 1, 2, 3, and 5; and so on, each letter being represented by a different combination of two or more of the stops. By the aid of a list of all the combinations used and of the letters to which they correspond, this system is easily learned, and it may be as easily read by the blind as the relief print now used.

A very useful though little known laboratory in Paris is that devoted to anthropometry, as applied to the identification of criminals. It is popularly called the 'Feet-bureau.' The reason for this peculiar name will be found farther on. In this laboratory every criminal, when taken into custody, is submitted to a thorough anthropometrical examination. He is divested of all clothing, and the form and dimensions of his head, face, fingers, feet, body, etc., are accurately noted down, and his face is photographed. There is already a collection of some sixty thousand photographs, and how can any particular photograph in this large collection be quickly found when required? This is the way M. Bertillon, the able director of the bureau, has classified them, so that he can readily find a photograph by which to identify any criminal whose picture is in the collection. The photographs are divided into three groups, according to the age of the criminal. Each of these groups is subdivided into three classes, according to the height of the person. A further subdivision of these classes is based upon the length of the head, and a final subdivision is governed by the length of the feet, — hence the name 'feet-bureau.' By this arrangement any desired picture among the

sixty thousand may be found in a moment, and on the back of it is a complete record of the criminal's past life, together with an accurate description of him. The bureau is very serviceable, the criminals being the only ones who find any fault with its workings.

An interesting paper upon the physiological action of saccharine — discovered some years ago by Fahlberg — has been contributed by MM. Aducco and Mosso. They find that frogs cannot live in a solution of this substance, on account of its acidity, though strong doses of a concentrated solution of it do not seem to affect them. Upon dogs, saccharine has no definite action. The weight of the animals is not changed by its use, and it has no effect upon the quantity or quality of the urine voided. Chlorides seem to be ejected in greater proportion, but this is all. Saccharine passes through the body without change, its only effect being to render the urine less putrescible than usual. Upon man the effects are similar, five-gram daily doses having no effect whatever, passing away wholly with the urine, entirely unchanged. Upon the whole, saccharine seems to be an inoffensive substance, having the valuable quality of being a substitute for sugar without the injurious effects of the latter in certain ailments, such as diabetes.

An excellent work upon hygienic dietetics has recently been published by M. Dujardin-Beaumetz, in which he ably reviews previous works upon the physiology of digestion, and advances sound ideas of what dietetics must be as governed by the various states of health and disease. Another work, by M. Dangeard, upon the inferior organisms, will prove useful to zoölogists and botanists. It is a book of reference concerning a very small division of protozoa, but contains no general ideas upon physiology or morphology. V.

Paris, Feb. 11.

## GEOGRAPHICAL NOTES.

### *Africa.*

The European population of Algiers in 1886 numbered 261,500 French and 210,000 foreigners. Among the latter the Spanish element is the most numerous. As among the French population there are 38,000 soldiers, and about a thousand foreigners are naturalized every year, the foreigners actually outnumber the French. The European population has doubled during the last twenty-five years, and the native population, which numbers 3,300,000 Arabs and Kabyles and 43,000 Israelites, is increasing at a rate of about 80,000 a year. Since 1881 the increase was 423,000.

Stanley publishes a letter in which he states that all the political authorities and experts in Cairo are opposed to the idea of his taking the Kongo route for reaching Emin Pasha. As his expedition will be well armed, they do not consider the obstacles he would find on the Karagwé or Masai route insuperable. Stanley, however, wishes to avoid a struggle with Uganda, as he fears that the missionaries now in Mwanga's power will be murdered in case of war. He estimates the length of the Kongo route at 157 days, — twenty days by steamer from Zanzibar to the Kongo, three days by steamer on the Lower Kongo, thirty-five days on the Upper Kongo, and ninety-nine days of land journey to Lake Mwootan. The Karagwé route he calculates at 156 days land journey, the Masai route at 154 days.

No news has been received of Mr. Lüderitz, who went on an exploring expedition in southwestern Africa last fall. He has not been heard of since he embarked on the Orange River in a canoe.

Dr. E. Holub's party has been attacked by the Bechuanas, and his companion was killed in the fight. Holub escaped unhurt. After the news of this disaster was received, a committee was formed in Vienna to raise funds for enabling Dr. Holub to resume his explorations on the upper Zambezi.

The French are making use of their occupation of Madagascar, says *Nature*, to gain a thorough knowledge of the natural history of the island. There have already issued from the national press several fascicules of a magnificent 'Histoire physique, naturelle, et politique de Madagascar,' edited by M. Alfred Grandidier, to be completed in thirty volumes quarto. The subjects to be comprised in this work are: 1°, physical and astronomical geography; 2°, meteorology and magnetism; 3°, ethnology, anthropology, and linguistics; 4°, political, colonial, and commercial history; 5°, natural history of mammals; 6°, natural history of birds; 7°, natural history of fishes; 8°, natural history of reptiles; 9°, natural history of Crustacea; 10°, natural history of terrestrial and freshwater mollusks; 11°, natural history of plants; 12°, geology and paleontology. The various sections are intrusted to competent authorities; and the geological portion is to be illustrated by about five hundred chromo-lithographs or colored plates, the anatomical details being represented in lithography and photography. The total number of plates will not be less than 1200.

### *America.*

Mr. Chaffanjon was going to leave San Fernando de Atabapo on the Upper Orinoco in November, 1886, to explore the sources of that river. Through the support of the government he got

some Moquivitares Indians for guides. They are the neighbors of the Guaharibos, who occupy the district of the sources of the Orinoco. The latter are very much feared by the whites, as they murder everybody who tries to enter their country. Chaffanjon hopes through the help of his Moquivitares friends to be able to gain their confidence and accomplish his purpose. On his way to San Fernando he made interesting linguistic and archeological researches.

### *Oceania.*

It is stated by *Nature* that the lake district in New Zealand is showing signs of fresh disturbances. Tremors have been felt at Rotorua, and Tarawera has emitted dense volumes of steam. The Wahanga Peak appeared most active. No fire was visible, and after this outburst everything quieted down again.

On the 15th of January a new volcanic eruption took place on Hawaii.

### *Oceans.*

The Proceedings of the Royal geographical society for December, 1886, contain an interesting paper by J. Y. Buchanan on 'Similarities in the physical geography of the great oceans.' The author mainly discusses three important oceanographical problems, — the equatorial current, the equatorial counter-current, and the rising of cold water near the coasts of continents. Buchanan describes the influence of the evaporation which takes place in the region of the dry and warm trade-winds and monsoons. The water which gets warmer but more concentrated sinks under the colder layers of less concentrated water, and thus becomes a medium of transportation of heat into the deeper strata. As this warm water is moving west, it reaches its greatest depth in the western parts of the oceans. As corals are confined to regions of warm water, they principally live in the same area. While the region of the equatorial current has water of great density, the equatorial counter-current has lighter water, and wherever the velocity of the eastern current is increasing, its density is decreasing. Buchanan does not give an explanation of the origin of the counter-current. His observations on the density agree with the well-known fact that the current lies beyond the belt of trade-winds which effect a rapid evaporation. The mechanical cause of this current remains still doubtful, though it seems probable that the equatorial current is its principal cause. Buchanan's remarks on the rising of cold water near the coasts of continents are of great interest. Formerly the existence of cold water was considered a sufficient proof for the existence of cold currents. Recent researches, however, make it probable that in such places cold abysmal water rises from the adjoining depths. Buchanan shows on a map that the cold water is principally found on windward coasts of the oceans, where the currents are flowing from the continent. The loss of water in these regions is made good by the rising cold water. The January number of the *Annalen der hydrographie* calls our attention to the fact that wherever a current is deflected from a coast, it attracts the adjoining water. It depends on the configuration of the ocean whether the abysmal water or that of the adjoining surface takes the place of the water that is carried away by the current. The rotation of the earth is the principal cause for the deflection of the currents and the consequent rising of the cold water. Every coast-current in the northern hemisphere is deflected to the right, in the southern to the left, and in all these places cold water may be observed.

### *General.*

The February number of the *Scottish geographical magazine* contains a paper by John Murray on the total rainfall of the globe, and its relation to the discharge of rivers, accompanied by a map showing the distribution of annual rainfall. According to Mr. Murray, 2,243 cubic miles of rain fall annually on areas with inland drainage. Such areas extend to 11,486,350 square miles. The land draining directly to the ocean has an area of 44,211,000 square miles. If from this quantity we subtract all areas having less than 10 inches of annual rainfall, we get 38,829,750 square miles. The mean discharge from this area into the ocean is 6,569 cubic miles annually. The total weight of substances carried by this means to the ocean is rather more than 5,000,000,000 tons each year.

## NOTES AND NEWS.

THE cholera epidemic is now declining in the Argentine Republic, having entirely disappeared from Cordoba. It still prevails in Montevideo, and has recently broken out at Frey Benitos, where the Liebig company has its slaughter-houses and factories for the preparation of the extract of meat. The La Plata River is closed to navigation on account of the epidemic. Although cholera has declined in the interior of the Argentine Republic, there is no change in the city of Buenos Ayres. There is no news from Paraguay, but it is learned from the Brazilian province of Matto Grosso that cholera is doing great havoc there. At Corumbá the people are terror-stricken and have fled into the interior. Fear is now enter-

tained that these refugees may spread the cholera into Goyaz and possibly into the Amazon region and to Pará.

— Following a period of apparent stagnation, due to the final arrangements as to site, programme, details of building, and the laying-out of the grounds, advices from the headquarters of the directors of the Paris jubilee of railways state that activity now prevails on the grounds, and that the palace and equipment will be ready for the opening in May.

— Messrs. Ticknor & Company announce for publication, on Friday, Feb. 25, 'The life and works of Giordano Bruno,' a new volume of the English and foreign philosophical library; 'The course of empire,' being outlines of the chief political changes in the history of the world, arranged by centuries, with variorum illustrations, by C. G. Wheeler, author of 'Familiar allusions,' with twenty-five maps; and 'Familiar allusions,' a handbook of miscellaneous information, including the names of celebrated statues, paintings, palaces, country-seats, ruins, churches, ships, streets, clubs, natural curiosities, and the like, by William A. Wheeler and Charles G. Wheeler.

— At a late meeting of the New York academy of medicine, Dr. J. H. Girdner read a paper on the methods of detecting and locating metallic masses in the human body by the induction balance and the telephonic probe. He referred to the apparatus which had been constructed by Professor Bell for the purpose of locating the bullet in the case of President Garfield, and said that it had failed because at the time the patient was lying on a metallic mattress, which interfered with the working of the instrument. Now we have an apparatus which will detect and locate any piece of metal, wherever situated in the human body. In the construction of the induction balance a bichromic battery is used, with six cells, and an ordinary interrupter, the interruptions being about six hundred to a second. The exploring coils were put in a framework of wood, which Professor Bell called the 'explorer,' while to the others the name 'adjusting coils' was given. Thus in the primary current were two coils, in the secondary current were also two coils, and in the circuit was a telephonic receiver. When the exploring coil was not in relation to a metallic substance, there was silence in the telephonic receiver; but, as the explorer approached or receded from the metallic mass, the balance was disturbed, producing a musical tone in the receiver. The sound is distinct six inches from the metal, if located in the human body. The telephonic probe consists of a telephonic receiver and two wires,—one terminating in a long, slender steel probe; and the other with a steel plate laid over the surface of the body in the neighborhood of the metallic mass, as determined by the induction balance. The steel probe being now plunged into the body, as soon as it reaches the metal a distinct click is heard. The practical working of the instrument was shown by locating a bullet in the chest of a soldier wounded during the civil war. A piece of lead was also recognized in the centre of a piece of beef.

— Sir J. William Dawson will prepare a volume for the International scientific series on the subject of the development of plants in geological time.

— The article by Prof. N. S. Shaler of Harvard, on 'The stability of the earth,' in the March *Scribner's*, will be accompanied by very numerous illustrations, which throw light upon the subject of earthquakes and other movements of the earth's crust.

— The persistence with which surgeons continue to employ chloroform as an anaesthetic in surgical operations, notwithstanding the overwhelming evidence of its danger, is beyond comprehension. We have called attention to this subject whenever deaths have resulted from this cause, and the number of such events has been considerable. Another has just occurred in Philadelphia. A lion-tamer in the service of Forepaugh had one of his fingers bitten by a colored man, and in the course of his treatment chloroform was administered. It is said that he died upon the table while still under the anaesthetic.

— Lieutenant Emory will sail early in March, in command of the Thetis, one of the Greely expedition relief-ships, for the Alaska coast.

— The U. S. fish-commission steamer Albatross is being fitted wiih new boilers, and will sail in the spring for her work on the Pacific, where, among other questions to be solved, will be that of the fish-bearing properties of the huge Kiu Sawa or Black Stream of Japan, which, crossing the Pacific in a high latitude, modifies the temperature and climate of Alaska and the Aleutian Archipelago in very much the same way that the Gulf Stream does the climate of England and the Shetland Islands.

— Dr. Gabriel E. Manigault of Charleston, S.C., has accepted the invitation of the geological survey to write a descriptive account of the incidents and effects of the earthquake of Aug. 31, 1886, for the forthcoming report on that subject. Dr. Manigault is an accomplished naturalist, and is curator of the museum in Charleston. He was in

the city at the time of the earthquake, and has since made a careful investigation of its incidents.

— Major Powell, director of the geological survey, in a statement which he has furnished for publication, says that there is no present likelihood of iron ore being exhausted in this country; but the remedy for prospective exhaustion is still further exploration for the mines to which the geologist points in various parts of the country.

— Commissioner Colman of the department of agriculture has issued a circular relating to the so-called 'Australian rabbit.' He says that the name is a misnomer, the animal being the common rabbit of Europe, which has been introduced in Australia. He recites its ravages in that country, and says that the introduction of the European species would be an unnecessary and hazardous experiment. He suggests that congress pass a law conferring upon the commissioner of agriculture the power to prevent the landing of any animal, bird, or other pest, in any port of the United States that in his opinion would be injurious to agriculture, in the same way that cattle infected with contagious diseases are now prohibited from entering our ports. He cites the case of the English sparrow, to show that it is unwise to transplant species which crowd out the native ones.

— We learn from the *Sidereal messenger* for February that Chicago may lose its astronomical observatory. The Dearborn observatory is the property of the Chicago astronomical society, but is upon ground leased to it by the now extinct University of Chicago, and may be required to vacate upon sixty days' notice. The society has received a request to transfer its instruments and library to an institution of learning outside of Chicago, but an effort is being made to obtain another site within the city.

— Another small comet was discovered by Barnard on the evening of Feb. 16. It is visible in a three-inch telescope. The great southern comet seems to have vanished as suddenly as it came. Though careful search has been made for it, we believe it has not been seen in the northern hemisphere.

— Nine comets passed the sun in review during the year 1886. One was a well-known periodic comet returning at the appointed time; and two of the new-comers appear to be moving in elliptic orbits, one of them identical, possibly, with De Vico's lost comet of 1844, or at least belonging to the 'same family' as the latter. Olbers' comet of 1815, which was expected at perihelion in December, 1886, has not been detected, but, as an uncertainty of over three years exists in the time of revolution, it may be picked up during the coming year. It is the only periodic comet expected in 1887. Two out of the nine comets were discovered in 1885, one in 1887, leaving six for 1886. Three were visible to the naked eye. Three belong to Barnard, three to Brooks. Two were found by Finlay, and one by Fabry. Comet 1886 IX. was picked up by three observers independently on three successive mornings in October, showing what a careful watch is kept for these little wanderers. Mr. Warner has paid eight hundred dollars in prize-money for the captures.

— As a result of the attempts to bring to pass an earlier publication of the Proceedings of the American association, the Proceedings of the Buffalo meeting held last summer were published during January of this year. Heretofore the Proceedings have not been published much within a year after the date of meeting. This promptness in publication has resulted partly from the reduced volume of the Proceedings, and partly by obliging the authors of papers to furnish abstracts prior to the time of reading them. Several of the addresses and reports were in type and stereotyped before the meeting, and others were held in type ready to be incorporated in the order of printing.

— The annual meeting of the Davenport academy of sciences was held in that city Jan. 26. The past year was one of unusual activity in the society, and large accessions were made to the collections.

— In the *Boston medical and surgical journal* we find an extract from the *Annales d'hygiène et médecine légale* which gives the observations of a French physician, Dr. Masson, on the footprints which are sometimes found at the scene of a murder, and the aid which they furnish in the detection of the perpetrator of the crime. The point which was especially studied was whether the marks discovered were made by one and the same foot, and so by one person only. He found that the same foot would give footprints with very different dimensions, according as it was used in standing or walking, corresponding with the two essential functions of the foot, as an organ of locomotion and of support. It appears to Dr. Masson impossible that two human footprints should closely resemble each other unless the same foot has made them. The impression made by a foot discloses such clear characteristics, the distinctive marks under different conditions are so numerous, the footprints of the same foot are so alike under dissimilar circumstances, that an attentive expert, having good footprints to study, ought to arrive at clear and precise conclusions. The toes, the great toe especially, leave marks that

should be examined attentively. These, and the outline of the digito-plantar depression, the line which defines the plantar arch, are the data for diagnosis. The conclusions which Dr. Masson draws, are, 1°, the dimensions and the shape of footprints made by the same foot vary with the attitudes taken; 2°, the two extreme and characteristic types are represented by impressions made by the foot in walking and in standing; 3°, the expert called to study the matter of footprints should always take impressions of the foot of the accused in the act of standing and of walking, and should compare only those which correspond with the same attitude; 4°, in connection with the measurements made, one should always consider the points which throw light upon the individual characteristics of the foot.

— We have received the first volume of the publications of the observatory ('History and work of the Warner observatory') founded by Mr. H. H. Warner of Rochester, N.Y., about six years ago, and now well known through its connection with the Warner comet prizes. The volume is published by Dr. Lewis Swift, the director, and gives a description of the observatory (a tower attached to the dwelling of the director) and the instruments, and a list of over four hundred nebulae discovered since July 9, 1883. About two-thirds of the pamphlet are taken up by 'The Warner prize essays.' These are, an essay on 'Comets; their composition, purpose, and effect upon the earth,' by Prof. Lewis Boss of the Dudley observatory; and four essays on the sky-glows, by Professor Kiessling, and Messrs. Clark, Maine, and Bishop respectively. The principal instrument of the observatory is an excellent 16-inch Clark equatorial provided with a filar micrometer and many convenient accessories. Its equipment is to be increased by a spectroscope, to cost $1,000, ordered from the Clarks. The observatory is also provided with a 4½-inch comet-seeker. Dr. Swift has devoted himself almost entirely to the discovery of new nebulae, and the search for comets, a field in which he has had nearly thirty years' training. It would seem ungracious to comment upon any of the shortcomings of the report; we suggest, however, that the usefulness of the observatory as an astronomical institution might be greatly increased if the director were provided with a thoroughly competent assistant, in order that his own work of discovery may be supplemented by careful study and measurement. It should be noted that Mr. Warner has expended more than $4,500 in astronomical prizes since Oct. 10, 1880.

— It seems that professors in Italy are chosen by a method that seems to be purely national. We quote from a recent article by R. Bonghi: — "For those who do not know, I should mention that in Italy the university professors are elected by the system of *concorsi*, for which there seems to be no exact English equivalent, and the particular method adopted has been altered several times, but is now the following: The faculty in which a professor is wanted proposes to the minister five names of ordinary professors of the subject for which a teacher is needed, or of cognate subjects, and if the minister approves of them he appoints them as a committee. To it every native or foreigner who thinks himself adapted for such a chair can send in his *titoli*; that is, his academical degrees and the books he has written. The committee, in a more or less explicit report, judges who is eligible, who not, and who among those considered eligible deserves the first place. Such a judgment presupposes that all the members of the committee should read and ponder carefully the books sent in by the candidates, but the general opinion is that they do not do so. It is commonly supposed that they meet with their minds already made up, and that they are proposed and nominated in such a manner as to insure their coming to the decision which will please either the faculty that proposes them or the minister who nominates them. This may not be true in all cases, but in some it doubtless is. At any rate, the report of the committee is then sent up to the superior council (of public instruction), which has nothing to do but to see that all due forms have been observed; which forms naturally always are observed, unless through some oversight in the drawing-up of the report."

## *LETTERS TO THE EDITOR.*

### Left-handedness.

ON p. 148 of the current volume of *Science*, mention is made of Dr. Wilson's view as to the cause of left-handedness.

In connection with this, Dr. Thomas Brown's suggestion in his 'Vulgar errors' (London, 1658) may be quoted. It occurs in the chapter, 'Of the right and left hand.'

"And therefore the brain, especially the spinal marrow, which is but the brain prolonged, hath a fairer plea hereto; for these are the principles of motion, wherein dextrality consists; and are divided within and without the Crany. By which division transmitting nerves respectively unto either side; according to the indifferency, or original and nativity prepotency, there ariseth an equality in both or prevalency in either side."

He does not lay much weight on this, for his conclusion is, —

"And thus have we at large declared that although the right be most commonly used; yet hath it no regular or certain root in nature." B.

Lexington, Va., Feb. 21.

## Calendar of Societies.

### *Anthropological society, Washington.*

*Feb.* 15. — Alfred Russell Wallace, Social economy *versus* political economy.

### *Biological society, Washington.*

*Feb.* 19. — E. D. Cope, An undescribed species of snake from the District of Columbia; The hyoid apparatus in the Urodele batracians; George Vasey, Remarks on a recent collection of Mexican grasses, made by Dr. E. Palmer; R. E. C. Stearns, Notes on Physianthus as a moth-trap; C. Hart Merriam, Contributions to North American mammalogy; F. A. Lucas, On the os prominens in birds of prey.

### *Philosophical society, Washington.*

*Feb.* 16. — M. H. Doolittle, Association ratios.

### *Engineers' club, Philadelphia.*

*Feb.* 5. — Morris P. Janney, The differential gauge as used at blast-furnaces; L. M. Haupt, The increased weight of locomotive engines as affecting the strains on railway-bridges.

### *Boston society of natural history.*

*Feb.* 16. — Thomas Dwight, On the range of variations in the human shoulder-blade; William Trelease, A study of North American Geraniaceae.

### *Engineers' club, St. Louis.*

*Feb.* 16. — Dr. Wellington Adams, The design and construction of dynamo-electric machinery.

## Publications received at Editor's Office, Feb. 14-19.

ANDERSON, W. On the conversion of heat into work. New York, Van Nostrand. 252 p. 12°.

FARNELL, G. S. Cornelius Nepos. New York, Macmillan. 128 p. 24°. 40 cents.

LANCASTER, A. Le climat de la Belgique en 1886. Bruxelles, Hayez. 75 p. 16°.

—— Liste générale des observatoires et des astronomes, des sociétés et des revues astronomiques. 2d ed. Bruxelles, Hayez. 114 p. 16°.

LOCKYER, J. N. The chemistry of the sun. New York, Macmillan. 457 p. 8°. $4.50.

MAXWELL, W. H. Primary lessons in language and composition. New York, Barnes. 12°. 35 cents.

MICHELIS. F. Antidarwinismus. Weber's Kritik der Weltansicht DuBois Reymonds und Sachs' Vorlesungen über Pflanzenphysiologie, zwei stumme Zeugen für die Richtigkeit meiner idealen Weltauffassung. Heidelberg, Weiss. 75 p. 12°. (New York, Stechert, 50 cents.)

NEW YORK agricultural experiment station, fifth annual report of the board of control of the, for 1886. Elmira, Advertiser assoc. pr. 398 p. 8°.

OLIVER, WAIT, and JONES. A treatise on algebra. Ithaca, N.Y., Finch. 412 p. 12°.

PEARSON, C. H., and STRONG, H. A., *eds.* D. Iunii Iuvenalis saturae xiii. Thirteen satires of Juvenal. Parts i. and ii. Oxford, Clarendon pr. 147+162 p. 12°. $1.50.

PFEIFFER, E. Die Analyse der Milch. Wiesbaden, Bergmann. 84 p. 8°. (New York, Stechert, 90 cents.)

PRENTICE, C. F. A treatise on simple and compound ophthalmic lenses. New York, James Prentice & Son. 41 p. 8°.

REICHEL, E. Shakespeare-Literatur. Stuttgart, Bonz. 502 p. 12.° (New York, Stechert, $3.15.)

RESCH, P. Die Entwickelungsstufen der Volkswirthschaft. Leipzig, Moser. 246 p. 12°. (New York, Stechert, $1.10.)

REUSCHLE, C. Praxis der Kurvendiskussion. Teil i.: Kurvendiskussion in Punktkoordinaten. Stuttgart, J. B. Metzler. 158 p. 12°. (New York, Stechert, $1.45.)

RICHTHOFEN, F. F. von. Führer für Forschungs-reisende. Berlin, Oppenheim. 745 p. 12°. (New York, Stechert, $5.90.)

ROHLF, G. Quid novi ex Africa? Cassel, Fischer. 288 p. 8°. (New York, Stechert, $1.90.)

ROSIN, H. Das Recht der oeffentlichen Genossenschaft. Freiburg, Mohr, 210 p. 8°. (New York, Stechert, $1.80.)

SCHAEFER, W. Die Nationalökonomie und die neuere deutsche Gesetzgebung. Hannover, Schmorl & von Seefeld. 95 p. 12°. (New York, Stechert, 55 cents.)

SCHUCHARDT, H. Romanisches und keltisches. Berlin, Oppenheim. 438 p. 12°. (New York, Stechert, $2.75.)

SCHWEDER, E. Ueber die Weltkarte des Kosmographen von Ravenna. Kiel, Lipsius & Tischer. 18 p. 8°. (New York, Stechert, 45 cents.)

SCHWEITZER, Ph. Island, Land und Leute, Geschichte, Litteratur und Sprache. Leipzig, Friedrich. 203 p. 8°. (New York, Stechert, $1.50.)

SEYDEL, R. Religion und Wissenschaft. Breslau, Schottlaender. 417 p. 8°. (New York, Stechert, $2.75.)

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TOULA, F. Mineralogische und petrographische Tabellen. Leipzig, Freytag. 161 p. 8°. (New York, Stechert, $1.50.)

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# SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 25, 1887.


## *BIOLOGY AND SOCIOLOGY.*

IN an article entitled 'Revolution and evolution,' printed in the *Contemporary review* for September, Mr. Leon Metchnikoff wages war against the opinions of those who would draw a close parallel between the biological relations of a community of zooids and the sociological conditions under which an ideal association of human individuals must occur.

According to Metchnikoff, there is a complete antithesis between the laws of the sociological and the biological domains; for the first have to do with aggregations of individuals maintained by *co-operation*, 'conscious or unconscious,' while the second concerns only groupings which are based on *struggle*. Then the author admits the occurrence of the sociological law in the biological community, but still strictly insists that individual struggle and communal co-operation are two forces of different kinds. He says (p. 432), "Whenever we see a phenomenon of association, — be it in the shape of a vegetable or animal organism, or that of a more perfect human community, — we cannot fail to detect something new, as essentially distinct from the law of individualistic competition or struggle as that specific Darwinian law itself is distinct from the Newtonian universal law of gravitation. That something is, namely, the consensus of a number of more or less individualized forces aiming at an end, not personal to one of the allies, but common to them all, and that is what we call *co-operation*." The conclusion seems to be, that, when we rise from the biological into the sociological domain, we can carry nothing useful from our toilsome studies on the way in which the organisms of nature have been built up and preserved, but must seek out a new law of deliberate altruistic co-operation, which is represented as having no relation to the natural impulse of the individual toward his own advancement.

Far from presuming to deal directly with so complex a question, it is the object of this paper to present the truth as regards one side of the problem by discovering, if possible, the true communal relations of the simplest *differentiae* making up the most complex animal body. It will be pointed out that biological data indicate no final antagonism between co-operation and struggle, but, on the contrary, that the one is the necessary antecedent of the other.

Living matter or protoplasm has, apparently, in all its forms, the same general functions; and such a study of relation as that proposed ought, if carried out on right lines, to lead us to a conception of the philosophy of protoplasm, by which is understood the main impulse or motive guiding individual and determining collective action.

Whatever may be the present and future subjects of biological dispute, the tidal wave of thought has lifted and grounded firmly beyond the danger of overthrow one grand general idea,— that every living organism may be anatomically analyzed into a greater or less number of physiological units — the cells or modified cells — which contain the living matter, and which, in function, though not in form, are like the parts they go to make up. The accuracy of this analysis is not affected by the differentiation of the cells themselves, nor would conclusions from it be disturbed should each cell itself be proved to represent a community of discrete factors.

It has come to be a fundamental doctrine of physiological teaching, that the higher animals may be looked upon as communities of living cells or modified cells whose functions determine the action of the organs they compose, and which are bound together by more or less not-living, intercellular matter, made, or at least modified, by the cells; and yet it appears that some of the most evident and important consequences that arise from this communal relation of different individuals, having needs and powers of all grades of similarity and dissimilarity, have been generally neglected or misunderstood. The analogy between the animal cell as related to the organism, and the human individual in his entirety as related to society, is a very striking one.

The cells of a body all take their nutriment from the same general pabulum: they all have the same general needs; and as the food-supply is a result of constructive effort, and therefore limited in quantity, there must be a struggle for food (or a struggle for existence) among the cells, which would be more severe the more nearly alike their individual needs. This statement will bear an illustration. We know that a blood-free muscle may, by artificial stimulation, be reduced to complete exhaustion; but, if a nutrient solution like blood-serum be now passed through the blood-

vessels, the muscle-substance, by virtue of its chemical affinities, extracts certain matters from the supply-fluid, and recovers its irritability and contractility. Now, we know that this unstable muscle-substance is continually being oxidized with the production of certain waste products. Suppose that the affinities of a given muscle-fibre for food matter are so feeble that less nutriment is brought in a given time into the tissue than is lost in the way of waste: the result is a gradual decadence or atrophy of that muscle. As in the physiological condition the food-supply is limited, those muscle-fibres with strongest constructive chemical affinities rob the weaker fibres, which could only get their fill, as it were, by a modification of physiological activity throughout the whole body. This explanation of the relation of growth to competition probably partly underlies the well-known fact of the extraordinary growth of one of a pair of similar organs, as a kidney, when its fellow is extirpated.

Owing to the physiological division of labor among the tissues, each one of these has come to depend nearly absolutely upon organs far removed for some of the essentials to its welfare: as, for example, a gland is often called upon during secretion to pour out a bulk of material greater than its own volume, and for the performance of this function there is an alteration of vaso-motor activity through which more blood visits the gland in time of need; and this vascular change, as also the secretion itself, is directly controlled by nerve-centres lying in the distant brain. So, elsewhere in the body, we are continually coming upon phenomena in which the working tissue appears to derive little direct benefit from its effort; the activity of each organ seems determined by, or at least co-ordinated with, the needs of its fellows; and this fact, indeed, constitutes the very definition of physiological activity.

If we invent a physiological allegory, whose personages are the animal cells supposed to be endowed with sensibility, reason, and motion, like in kind to the faculties of complete organisms, we should find that the fanciful sketch of the cellular society constructed on such a scheme corresponds remarkably well, if not identically, with the actual result of such associations of cells as we find them in living organisms. The apparent altruism noted above is perhaps most marked in the working of the respiratory nerve-centre on whose rhythmic impulses directly depends the contraction of the respiratory muscles which expand the chest, and thus draw into the lungs the fresh air necessary to the life of the whole body.

This nerve-centre is generally supposed to be composed essentially of a group of nerve-cells occupying an insignificant area of the brain; and on their ceaseless, rhythmic output of energy every living molecule of the body each moment derives benefit without giving any manifest adequate return. Still, though each new study of the body brings to view fresh examples of the subservience of individual needs of the physiological units to the welfare of the community of cells, it can be shown as scarcely doubtful that this altruism, apparently purposive on the part of the living integers, is but an indirect outcome of an effort for their own aggrandizement, their supreme selfishness, as it were. There is the strongest reason to believe that the physiological individual, or cell, in a complex organism, is primarily as completely bent upon its own nutritive welfare, and as regardless of the condition of its neighbors, as if it were a free monad contending for sustenance against a myriad of its fellows in a culture-solution. Even in the case of the action of the respiratory centre, which seems devoted purely to aims benevolent to the organism as a whole, experiment indicates that any such benefit conferred outside the centre itself is, as it were, a mere accident in its activity.

It is the present belief of physiologists that the nerve-cells of the respiratory centre are stimulated by a lack of oxygen to discharge energy into the motor nerves arising from them; and their discharges, up to a certain point, increase in vigor with diminution of oxygen-supply, and conversely become weaker and less frequent when that gas is in excess in the blood. If oxygen fail totally, the cells soon die. Now, suppose an animal to be in a state of respiratory quiescence: oxygen is still being drawn from the blood by every living tissue. As a result of this, there is failure of oxygen in the respiratory centre; and a stimulus of some sort is heaped up in the nerve-cells there, until finally an explosion of energy proceeds from them into their motor nerves, and thence to the muscles of inspiration which cause the chest to expand. Thereby fresh air is drawn into the lungs, new oxygen diffuses into the blood, and thus the excitement of the respiratory centre is allayed for a while, presumably owing to the oxidation in the centre of some irritating chemical products of tissue-change.

It has been found, that, if the manner of circulation is artificially so altered in a living animal that the brain still receives blood oxidized to its normal arterial condition, while tissues of the trunk or limbs get only venous blood or even none at all, the rhythmic action of the respiratory centre goes on undisturbed, though the organs with altered circulation soon die from asphyxia. On the contrary, should the arteries conveying

blood to the brain be clamped, thus cutting off the oxygen-supply and abolishing the removal of waste, or should the blood passing through them be artificially warmed, thus hastening the chemical changes in the nerve-centres without a corresponding increase in the rapidity of food-supply and waste-removal, the deep and energetic breathing of dyspnoea soon shows the pressing need of the centre for fresh oxygen; and the animal may die, as far as its brain is concerned, in the convulsions of asphyxia, though the great bulk of its body is unaffected, and lives on in perfect rest so soon as the exhausted brain can no longer stir its muscles to contraction.

If we arrange a narcotized living animal in such a way as to observe the changes in the amount of its arterial blood-pressure while supplying air by artificial respiration, it will be observed that the pressure rises when the respiration fails ever so little, and the elevation is most marked when the muscular contractions of extreme dyspnoea appear. Now, it is this arterial pressure which drives the nutrient blood on its way. The blood-current is stronger and swifter, the greater the pressure; and the result of such a change is to present each tissue with a more abundant supply of oxygen and other food-materials. The rise of pressure noticed in the first instance was due to the contraction of the living walls of the blood-vessels throughout the body: they responded directly, or were made to respond indirectly through their motor nerves, to the need of the oxygen in their local areas and in the brain; and the result of this action was to supply with all despatch the respiratory centre with whatever store of oxygen there was in the blood. So we have the all-important fact of the mutual helpfulness of the bodily tissues on the one hand, and the respiratory nerve-cells on the other, brought about by the independent exertion of each living factor of the body in its own behalf. Every physiologist knows experimentally how the whole body rises in protest, as it were, at any interference with the free performance of the respiratory functions; and that little group of cells whose business it is to initiate the movements of breathing are thus protected from want by every part of the body, which is itself dependent on them. A complete record of all such co-ordinate actions would form a treatise on physiology, and a consideration of all the results justifies this generalization: that every physiological unit of a complex organism labors for its own aggrandizement alone; but its existence is conditioned by an association with neighbors, with which it must compete and upon which it depends; and this union has the suggestive result that every living cell in the body receives aid and protection from its neighbors in proportion as it, in turn, by its activity, furnishes them with aid and protection.

This remarkable union of the energies of the morphological elements of the body, which suggests so clearly the social relations of an ideal community, finds its explanation in the ground law of the doctrine of evolution. If we but presume the fact of a struggle for existence among the tissue-factors, the survival of the fittest must be a corollary to that proposition; and the fittest individual is that whose life best tends to preserve the welfare of the organism as a whole, for on this depends the existence of each of its constituent parts.

The farther we peer into the mysteries of the living animal, new utilitarian beauties are disclosed with every secret unfolded; and the time is probably not far distant when it will be difficult to point out a structure or function which, far from being simply useless, has not a definite purpose aimed at preserving the safety or perfecting the economy of energy-discharge of the whole body. Even if one bears in mind the well-known criticism on the imperfection of the eye as an optical instrument, his view would be one-sided and unjust if content to rest there. The errors of normal vision are nearly all errors of judgment: which is a subjective process, and it is presumable that finer workmanship in the optical camera would be useless in arousing sensations of greater advantage to the organism.

From a physiological point of view, the physical environment of an animal has only a remote though a certain and most complex relation to changes in the organism. Now, any change of the environment must be followed by a kaleidoscopic alteration in the relations of the tissues among themselves, and these may be very profound without any necessary variation of the total vital configuration. Dr. Romanes, in his recent exposition concerning physiological selection as a means of accounting for the origin of species, has done good service in looking directly at the independent variable — the animal cell — in seeking a solution of the intricate problem presented by the body as a whole.

If this analogy between the communal relations of living cells in the body and those of individuals in human society have a foundation in fact, we ought to be able to use the parallel as a path of research, and, from what is known concerning the evolution of society, gain light as to the physiological relation within parts of the body which yield their facts very sparingly to investigation.

A well-known physiologist has called the central nervous system the final battle-ground of the

science. If we look upon these mysterious nerve-cells as a community of reasoning individuals, we should expect to find a division of labor among them which should restrict more or less completely the physiological activity of each anatomical area. What we know of the subject justifies this comparison. We find the nerve-cells of the medulla and spinal cord inheriting automatic and reflex powers of comparatively simple character, but of vital importance to the life of the whole system; and there is reason to believe that these powers are more extensive and efficient the longer they have been impressed by heredity. When we ascend from the medulla to the cerebellum, we come upon powers of the same kind, but vastly more complex in their co-ordinations; and here, or hereabouts, we meet a new faculty,— that of *learning* reflexes, or learning to carry on a complicated action with machine-like definiteness and celerity in obedience to a given stimulus. The complex motions of walking, balancing, the performance of an experienced pianist, are largely reflexes whose centres, in all probability, lie in this part of the brain. Then we gradually rise through nerve-centre after nerve-centre, with graduated physiological powers, till we reach the Teacher himself, whose energy is, doubtless, that of the cortical cerebral cells. Nothing is clearer in physiology than this general differentiation of function among the nerve-centres, and it is altogether probable that a physiological differentiation even goes hand in hand with the morphological one which histologists have shown to involve the matter making up the individual animal cell itself.

Looking at the cortical cells again as a community, we should expect that the complex of powers of the society should be divided up and portioned off to distinct individuals which should inherit extreme facility of action in a definite province without altogether losing the other, now subordinated, functions with which they were originally endowed. Artificial stimulation of definite cortical areas we should expect to be followed by a manifestation of their specific function; and, on the contrary, annihilation of such a region ought to be followed by a corresponding paralysis, which would not be permanent, because neighboring cells would gradually develop the lost function, the power to perform which had hitherto been latent in them. Each new lesion would be followed by a crippling involving the same features, and the recovery would each time be less perfect. This presentation may be taken, as far as the results go, as the actual outcome of experimentation on the brain; and the same history would be repeated by any civilized community in which the various trades and professions should, in turn, be deprived of their workers.

Physiological phenomena are those in which the activities of various tissues are co-ordinated in such a way as to produce a combined action; and we may consider each tissue-element as a reasoning individual which associates physiologically with its neighbors only so far as a result of this union is beneficial to its own welfare.

Turning now from the normal body to view the phenomena of pathology, we enter a field which has been too incompletely surveyed for us to trace our way at will in it; but so far as pathological processes are understood, they seem to be guided by the same law of endeavor for self-aggrandizement on the part of the living cells concerned, as in those actions already considered. When an arterial wall becomes cheesy or chalky in atheroma as a result of increased arterial strain, we see living tissue-elements redeveloping some of their suppressed embryonic powers of metabolism, and replacing their sentient, overworked protoplasm by an inert substance incapable of either evolving energy or suffering from overstrain. Unfortunately this ostrich-like hiding of the head is an ill-judged attempt at self-preservation; for it entails increased labor on other organs, which may result in fatal inco-ordination. So, also, when a foreign particle within the body is encysted by an envelope of tissue developed for that purpose, the whole process goes on as if the active cells had distinctly in view the covering-up of a hurtfully irritating object.

Those pathological processes which are more usual grade imperceptibly into the physiological; as, for instance, those phenomena of altered circulation and growth attending the healing of the fracture in a broken bone.

Only a competent pathologist could give full force to the proposition here stated: but there seems to be convincing evidence that in pathological as in physiological processes there is a distinct effort, on the part of the acting protoplasm, towards self-aggrandizement; that is, to reduce its expenditure and to increase its income of energy. In the physiological process the various factors work together in such a way that the resultant effort is of the greatest possible benefit to each separate member without detriment to any other. In an extreme pathological action the selfishness of some single individual brings ruin on the whole organism, because regardless of the fact that unlimited self-aggrandizement is hurtful to the remainder of the community. We may profitably compare these two biological conditions to the states of discipline on shipboard as they may be observed respectively in calm weather and during great

excitement. In the first instance every movement is carried out, and every duty is performed, with relation to a common purpose,— the most complete welfare of ship and crew; but no one can doubt that the individual motive of each sailor is to thereby bring the greatest benefit to himself. In the unusual occurrence of threatened shipwreck, however, this co-ordination is lost, because the selfishness of each individual in seeking his own safety causes him to disregard the duty he owes his companions, and the result ant is fatal in-co-ordination.

If what we have said be true, the premise assumed by Metchnikoff is fundamentally wrong. The doctrine of evolution applied to the living organism teaches, not that there is final antagonism between struggle and co-operation, but that co-ordination and the well-being of the whole is the natural outcome of struggle for existence among the individual particles of the body; and, presuming capability of variation, there must, through 'survival of the fittest,' come to be increase of specialization and perfection of performance in every function. Fatal or merely injurious pathological processes, when traced to their source, are found to be due to accidents which do not come under the head of uniform law. Supposing such an accident to occur so frequently as to become a normal event: the vital elasticity of the organism re-adjusts itself to these new conditions involved, so that they (as in the case of the bone-fracture) are hardly distinguishable from ordinary physiological processes.

HENRY SEWALL.

## THE BRITISH COMMISSION ON THE DEPRESSION OF TRADE.

IN response to a general feeling of anxiety, some of it expressed openly and some not, a royal commission was appointed some months since by the British government to take into consideration the depression of trade and industry in Great Britain, and to report by what means, if any, the depression could be remedied. The final report of the commission has recently been published, and it bristles with points of both theoretical and practical interest. The report is by no means unanimous. A majority report is signed by the late Earl of Iddesleigh, the able president of the commission, and eighteen of his fellows. Eleven of these, however, sign under certain restrictions and reservations, which they append over their respective signatures. The minority report, which represents the views of the so-called fair-trade party, is signed by Lord Dunraven and three others. A third report is submitted by Mr. Arthur O'Connor, and signed only by himself.

The majority report begins by mentioning the general points of agreement among all the witnesses examined. These are said to be, 1°, that the trade and industry of the country are in a condition which may fairly be described as depressed; 2°, that this depression takes the form of a diminution, and in some cases an absence, of profit, with a corresponding diminution of employment for the laboring classes; 3°, that neither the volume of trade, nor the amount of capital invested therein, has materially fallen off, though the latter has in many cases depreciated in value; and, 4°, that this depression dates from about the year 1875, and that, with the exception of a short period of prosperity enjoyed by certain branches of trade in the years 1880 to 1883, it has proceeded with tolerable uniformity, and has affected the trade and industry of the country generally, but more especially those branches which are connected with agriculture.

This unanimity did not extend, however, to the causes which brought the depression about. But those causes to which any great importance was attached were, 1°, over-production; 2°, a continuous fall of prices, caused by an appreciation of the standard of value; 3°, the effect of foreign tariffs and bounties, and the restrictive commercial policy of foreign countries in limiting English markets; 4°, foreign competition; 5°, an increase in local taxation; 6°, cheaper rates of transportation enjoyed by foreign competitors; 7°, legislation affecting the employment of labor in industrial undertakings; 8°, superior technical education of foreign workmen.

It is pointed out that it is from the employers of labor and producers that most complaints of trade-depression have come; but the report adds, that its signers are satisfied that in recent years, and particularly in the years during which the depression has prevailed, the production of commodities generally, and the accumulation of capital in the country, have been proceeding at a rate more rapid than the increase of population; and in support of this the statistics as to pauperism, education, crime, and savings banks, are cited. The statistics of foreign trade show an apparent falling-off in some respects; but this is attributed almost entirely to the continuous fall in prices, especially those of raw materials, since 1873. After making allowance for this fall in prices and for the fall in the price of raw materials, it is held that the actual products of British labor and capital have largely increased. It is pointed out, for example, that, if valued at the prices current in 1873, the aggregate of the foreign trade of Great

Britain for 1883 would have amounted to 861,000,-000 pounds sterling, instead of, as it appears now, 667,000,000 pounds sterling.

This conclusion, however, is untrue in the case of agriculture, where it is found that the quantity of produce raised in Great Britain during the last few years has materially decreased, and the steady fall in prices has been felt even more severely than the diminished yield of the soil; and it is the section of the community interested in agriculture which the commission finds particularly affected by the depression. The complaints as to absence of profit, though general, are not uniform. The evidence shows, however, that while business is not absolutely less in quantity, it is carried on with the smallest possible margin of profit, and in some cases with no profit at all. Nevertheless it is pointed out that the gross amount of property and profits assessed to the income-tax in the years 1885 and 1886 is much larger than that of any previous year. Too much stress cannot be laid upon these figures, because the increase of the income-tax assessment is in great degree attributable to the increased efficiency of collection. It is further stated that in some cases the tax is paid on profits not earned, because of the unwillingness of traders to make known the fact that they have sustained losses.

But the absence or diminution of profits is not the only marked feature of the prevailing depression, though it is the most universal one. The supply of commodities is found to be in excess of the demand, and the natural tendency to equilibrium between them seems to have been obstructed for an unusually long period. And this excess of supply is maintained in the face of unremunerative prices. The chief features of the commercial situation are thus summed up: 1°, a very serious falling-off in the exchangeable value of the produce of the soil; 2°, an increased production of nearly all other classes of commodities; 3°, a tendency in the supply of commodities to outrun the demand; 4°, a consequent diminution in the profit obtainable by production; and, 5°, a similar diminution in the rate of interest on invested capital. The diminution in the rate of profit obtainable from production, whether agricultural or manufacturing, has given rise to the wide-spread feeling of depression among all the producing classes. Those, on the other hand, who are in receipt of fixed salaries, or who draw their incomes from fixed investments, have little to complain of. The same thing is true with regard to the laboring class, so far as the purchasing power of wages is concerned. Some distress is created among the laboring classes by the displacement of labor, which is always in progress owing to the increased use of machinery and other changes of production; and last winter this distress was aggravated by the severity of the weather.

The report then takes up the causes which the signers believe have assisted to produce the depression. It goes on, "we have shown that the production of the more important classes of commodities has, on the whole, continued to increase; and there can be no doubt that the cost of production tends to diminish. It is difficult, therefore, to understand how the net product of industry, which constitutes the wealth of the country, can have failed to increase also. There is, moreover, sufficient evidence that capital has, on the whole, continued to accumulate throughout the period which is described as depressed, though there has been a sensible depreciation in the value of some kinds of capital. How, then, are we to account for the general sense of depression which undoubtedly exists, and is becoming perhaps more intense every year?"

The view which the signers of the majority report adopt is that the aggregate wealth of the country is being distributed differently, and that a large part of the prevailing complaints and the general sense of depression may be accounted for by the changes which have taken place in recent years in the apportionment and distribution of profits. The reward of capital and management has become less, and the employment of labor is, for the time at least, not so full and continuous; so that even where the rate of wages has not been diminished, the total amount earned by the laborer has been less, owing to irregular or partial employment. Setting aside the classes immediately dependent upon agriculture for their incomes, and considering those only engaged directly in commercial enterprises, it is found that the total amount of profits on which the income tax has been paid has increased, as has also the number of persons assessed. In the decade from 1875 to 1885 the number of incomes assessed under schedule D of the income-tax list, amounting to £200 or more, increased from 184,354 to 239,367, a gain of nearly thirty per cent. But the increase was much more rapid at the lower end of the scale than at the upper; for it seems that the number of persons with incomes of less than £2,000 a year has increased at a more rapid rate than the population, — which during the period in question has increased about ten per cent, — while the number of person with incomes above £2,000 has increased at a less rapid rate, and the number of persons with incomes above £5,000 has actually diminished. The rule is, the lower the income the more rapid the rate of increase. The conclusion

from this is, that, whether profits are increasing or not, there is direct evidence that profits are becoming more widely distributed among the classes engaged in trade and industry, and that, while the larger capitalists may be receiving a lower return than that to which they have been accustomed, the number of those who are making a profit, though possibly a small one, has largely increased.

The signers recognize the fact that over-production may exist for a time and in certain branches of industry, and that it tends to correct itself. But they are more or less at a loss to account for an over-production at once so general and so long-continued as the one under consideration has been. They are disposed, however, to explain this as the effect of the protectionist policy of so many foreign countries, which has become more marked during the past decade than ever before. "The high prices which protection secures to the producer within the protected area naturally stimulate production, and impel him to engage in competition in foreign markets. The surplus production which cannot find a market at home is sent abroad, and in foreign markets undersells the commodities produced under less artificial conditions."

A share of the blame, if blame it can be called, for the depression, is laid upon the working of the limited liability system. Under this the capital invested in small sums by a large number of individual shareholders is, as a rule, contented with a lower rate of interest than the ordinary producer will require upon the capital which he employs at his sole and unlimited risk. The tendency of limited liability companies is also to undertake enterprises with regard rather to the creation and speedy sale of the shares at a premium than to their permanent prosperity. The limitation of the liability further serves to encourage a less cautious or more speculative system of trading than can safely be pursued by a trader who is himself liable for the full extent of his operations. The report offers no opinion as to the benefit derived by the community at large from the limited liability companies, but simply points out the important influence which they have exercised both upon the extent of production and the rate of profit obtainable on the capital employed in it. The fact that stocks held by middle-men have become available for consumption without replacement, because of the more rapid and direct communication between the producer and the consumer, has tended to depress prices and profits; and there is also to be taken into consideration the fact that the possibilities of new demands throughout the world are becoming annually more limited: it is consequently predicted that in future more stability in the ratio of supply to demand may be expected, with a more regular though reduced rate of profit.

The report next considers at much length the fall of prices. The reasons for this may be briefly enumerated as an appreciation of the standard of value, a decreased demand both in domestic and foreign markets, — the latter attributed in large degree to the operation of protective tariffs, — and the fact that the reputation of British workmanship does not stand as high as it once did. The fraudulent stamping of foreign goods of inferior quality with British marks has had something to do in bringing about this result; and many witnesses before the commission believed that legislative restrictions on labor, and the action of the working-classes themselves in increasing the cost of production by strikes, and so forth, have had an important effect. The majority report, however, dissents from the view of these witnesses.

When it comes to the question of remedies for the depression, the report becomes more vague and indefinite. The cost of production must be cheapened so far as is consistent with the maintenance of sound quality and good workmanship. The increasing severity of foreign competition must be met. New markets must be sought for. Technical and commercial schools must be developed and improved until they are equal to those on the continent of Europe. Legislation is needed to make more effective the provisions of the existing laws as to the counterfeit or fraudulent marking of goods. The law as to limited liability companies is susceptible of improvement, though the report fails to point out how. The report then concludes, "We think that while, on the one hand, the information which we have been able to collect will tend to dispel much of the apprehension which appears to prevail on the subject of our commercial position, and to encourage a more hopeful view of the situation, it will also show, that, if our position is to be maintained, it must be by the exercise of the same energy, perseverance, self-restraint, and readiness of resource, by which it was originally created."

The minority report is of interest, because it embodies the views of Lord Dunraven and his fellow-advocates of fair trade. In its analysis of the depression, it is in almost entire agreement with the majority report; its individuality consists in its recommendations. It mentions and approves the remedies outlined by the majority of the commission, but finds that they leave untouched the greatest and most permanent causes of the depression, which are the action of foreign

bounties and tariffs, and the growing effect of directly or indirectly subsidized foreign competition. These are not natural, but artificially created difficulties. They will increase rather than diminish. To counteract them it is not recommended that a like system of import duties be established, but the minority believe that "a slightly preferential treatment of the food-products of India and the colonies over those of foreign nations would, if adopted as a permanent system, gradually but certainly direct the flow of food-growing capital and labor more towards our own dependencies and less towards the United States than heretofore. When it it is noted that in the year 1884 the Australian colonies, with only 3,100,000 inhabitants, purchased £23,895,858 worth of our manufactures, while the United States, with about 55,000,000 inhabitants, purchased only £24,424,636 worth, it will be apparent how great would be the effect of a policy which should lead to the more rapid peopling of the Australian colonies in giving fuller employment to our working-classes at home, and thus increasing the healthful activity of the home trade, as well as the import of raw materials for our various industries to operate upon."

It is thought that "specific duties, equal to about ten per cent on a low range of values, imposed upon the import from foreign countries of those articles of food which India and the colonies are well able to produce, would sufficiently effect this purpose. Their adoption would, of course, involve the abolition of the heavy duties on tea, coffee, cocoa, and dried fruits, which are now levied on Indian and colonial, equally with foreign, produce. It would widen the basis of our revenue, and render us less dependent upon the sustained productiveness of the income-tax and the duties upon intoxicating liquors; and, what is even more important, it could not fail to draw closer all portions of the empire in the bond of mutual interests, and thus pave the way towards a more effective union for common objects. For there would be no exclusion of foreign food-products: they would come in on payment of the duty named; and we are convinced, that, if any effect were produced upon the prices of the articles in question, it would be very slight indeed, and limited in duration to the time required, under the stimulus of preferential treatment, to increase the production of them in India and the colonies."

Besides this, a duty of 2s. 4d. per hundredweight on sugar is advocated to offset the sugar bounties. "Its effect would be to restore to the producers of sugar in our colonies and in India, and to the refiners in this country, the just right of competition on practically equal terms, and to transfer to our own exchequer the export bounties given by foreign nations. The position of the British consumer would be the same as if we had by negotiation obtained an equivalent reduction of the bounties, while in his quality of tax-payer he would be a gainer by the diversion of foreign money into our exchequer so long as the bounty-receiving importations continued."

These are the main features of the reports which have been looked for with considerable interest by the commercial classes and economists both in this country and in England. How far future legislation will embody their recommendations, and how successful they will be if enacted into laws, remains to be seen.

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As a substitute for gunpowder, dynamite, or other explosive requiring ignition, Dr. Kosman proposes, for use in mines containing inflammable gases, cartridges filled with dilute sulphuric acid and zinc-dust (the mixture of finely divided zinc and zinc oxide that collects in the condensers of the zinc retorts). The cartridge-case is a glass cylinder divided into two chambers, one being four times the capacity of the other. The larger chamber contains the acid, the zinc-powder being placed in the other when the cartridge is about to be used. The cartridge is inserted in the shot-hole in the usual manner, a 'shooting-needle' being first passed through the zinc-powder to a plug in the partition separating the two chambers. The shot-hole is them tamped in the ordinary way, the end of the needle projecting at the surface. A tap on the needle displaces the plug and breaks the glass partition, when a rapid evolution of hydrogen takes place with sufficient expansive power to do the work of the explosive cartridge, but without its danger.

— General Lefroy, formerly director of the Toronto observatory, who is considered to be the best authority on terrestrial magnetism in Canada and the British possessions, pays the following compliment to the work done by the United States in this direction: "The United States appear to be in advance of most European countries in current knowledge of the facts of the earth's magnetism, but the magnetic survey of the British Islands is again in progress, and we shall soon be up to date again." In this connection it may be well to state that France has just made a magnetic survey of its area, and in England the third one is now being made; central Europe had but one magnetic survey; the Russians are alive to this important work; and Japan has just completed a fine survey, 200 stations occupied, with the curious result of a connection of the magnetic curves with the lines of folding of the geological strata.

# SCIENCE.

FRIDAY, MARCH 4, 1887.

## COMMENT AND CRITICISM.

PROF. C. S. SARGENT, director of the Arnold arboretum of Harvard college, takes occasion to reverse some of his earlier advice, in an article printed in a recent report of the Massachusetts state board of agriculture on the subject of tree-planting. He had been, like most American writers on forestry, strongly impressed with the value of foreign trees for general cultivation in New England; but as imported trees grow older they do not fulfil the promise of their earlier years, and he has therefore become convinced that natives are better suited to our climate and soil than any exotics can be. The willow alone, of all foreign introduced trees, has qualities not possessed in a greater degree by some native. The European oak is perhaps the most unsatisfactory deciduous tree that has been experimented upon: it grows rapidly when young, but fails, when about twenty years old, from the cracking of the main stem, and then, after dragging out a wretched existence a few years longer, miserably perishes. The Scotch pine is a failure in New England as an ornamental or a timber tree: it perishes long before reaching maturity, and the discovery of its worthlessness has cost American planters something in money and a great deal in disappointed hopes. The Austrian and the Corsican pine seem to be no better. The Norway spruce has been for many years the most widely cultivated foreign tree in Massachusetts: it is cheap, easily transplanted, and grows rapidly and gracefully when young; but the general introduction of this tree into our plantations must, nevertheless, be regarded as a public misfortune. It must be acknowledged to be a complete failure in eastern America: it will never produce timber here, and it is decrepit and unsightly just at that period of life when trees should become really handsome in full development.

These facts cannot be generally appreciated, for Professor Sargent estimates that five foreign trees are now planted to one native. But some progress in native sylviculture has been made in the south-eastern counties of Barnstable and Plymouth, where the farmers have learned how to plant and raise forests successfully and profitably. "It has been demonstrated in Barnstable county that a crop of pitch-pine can be raised from seed with as much certainty as a crop of corn, and with much less expense; and that the loose and shifting sands of Cape Cod, useless for every other purpose, can, with the aid of this tree, be made to bear valuable crops of wood." There are also plantations of white-pine, dug as seedlings in the woods, made forty or fifty years ago in the barren, sandy, exhausted soil of Middleborough and Bridgewater. The young trees were set out in shallow furrows at odd times with little expense, and required no subsequent care. Men are now living in these towns who have cut and sold white-pine saw-logs at the rate of $150 an acre, from seedlings set by themselves. These are no doubt the most successful and profitable attempts at sylviculture ever made in the United States; and, although the best methods of planting are not yet so fully understood as in the case of the pitch-pine, the experiments show that the white-pine, the most valuable trees in New England, can be cultivated with success and profit.

The supply of railroad-ties is a matter of growing importance for the New England farmer, and certain experiments made at the suggestion of Professor Sargent by the Boston and Providence railroad have an important bearing on it. Fifty-two ties were laid in December, 1878, on a track in Boston where the traffic is very heavy, having an average of sixty-five trains daily. Ten kinds of wood were tried, five in the natural state and five creosoted. None of the ties rotted, except one of the ailantus: the others that had to be removed had been injured by the hammering of the trains. Spruce, hemlock, larch, and southern pine have all suffered badly in this way. White-oak lasted well, but it holds the spikes so firmly that they cannot be drawn when the rails have to be shifted. Creosoted elm and birch did well, and are to be recommended. Chestnut was unfortunately not included in the experiment, although it is considered one of the best woods for ties. The behavior of the catalpa was one of the most interesting fea-

No. 213—1887.

tures of the case: it has been highly spoken of for ties on account of its practical indestructibility when placed in the soil, and all the ties of this wood here tried are still sound, except just under the rails, where they are crushed nearly to pulp, so as to be of no service whatever for roads of heavy traffic.

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IN A RECENT number of *Science* we noted some instances in which large employers had given favorable testimony to the action of profit-sharing in promoting good feeling and harmonious relations between employers and employees. The reverse side is presented very forcibly and clearly by Mr. Richard Aldrich in the *Quarterly journal of economics*. Mr. Aldrich points out that any system, such as profit-sharing or industrial partnership, which promises so momentous results, must be subjected to a most careful examination before receiving the stamp of approval. The inductive evidence so far obtained, he contends, is not sufficient, because the data included in it are so few, the whole number of instances collected not being more than one hundred, — a very minute speck in the whole world of business. Furthermore, the actual application of the system of profit-sharing has been so limited that the cases, from their very novelty, have often been surrounded by a set of special circumstances, and to eliminate the effect of these a large number of cases must be averaged. Induction being, for the present, inconclusive, it is necessary to turn to theoretical and *a priori* considerations. In applying these, in turn, profit-sharing must be viewed as a permanent and prevalent industrial system, and not as exceptional and experimental. Then the first consideration is that profit-sharing is unfair, in that it disturbs the natural working of wages and pays the employee twice over — his insured part of the product represented by wages, and a premium besides. The latter is taken from what should accrue to capital, and is over and above the commuted and fixed advanced share of the product, to which alone the employee is entitled.

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Furthermore, profit-sharing implies some profits to share; but what happens, Mr. Aldrich asks, — and this is a point we have frequently emphasized in *Science*, — if instead of a profit there should be a loss? Logically, profit-sharing must and does imply loss-sharing. But this is impossible, and while capital is asked to share prosperity, it must shoulder adversity alone. It, of course, suggests itself that a reserve fund might be established in good years to be used in bad ones, but there are practical objections to this. In the first place, the stimulus to the employee which profit-sharing is supposed to furnish by holding out a prospect of immediate gain, is blunted by any claim on the gross profits other than the necessary ones of interest on capital, and profit on the same; and, secondly, the exact amount of the reserve fund would be difficult to determine. Another and a very forcible objection to profit-sharing is, that, in order to protect the employees, a full publication of the accounts of the business would be necessary. This would render business impossible. Secrecy in accounts is a most important element in the security and stability of any business, however sound. Mr. Aldrich develops all these considerations somewhat, and then mentions the very interesting and suggestive point, hitherto generally overlooked, that, because of the importance of the *entrepreneur* in the modern industrial system, the result of the widely-spread adoption of industrial partnerships would be to subordinate the pay of the laborer to the success of the capitalist who employs him. Where capital plays a subordinate part, where the functions of the *entrepreneur* are reduced to a minimum, there will industrial partnership be applied with greatest chance of success. But suppose, says Mr. Aldrich, that profit-sharing does all that is claimed for it by its advocates, and is introduced generally, in what respect will the situation of labor and capital be changed? The satisfactory results now attested to are due to the present exceptional character of the system. "The glamour and emotional interest which surround the experiments in industrial partnership have prevented any practical test from ever yet being made that would give the system an undoubted claim to be considered a solution of the 'labor problem.'"

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THE DENTISTS OF MASSACHUSETTS are again endeavoring to secure a legislative act establishing a board of registration in dentistry. Such an act almost became a law several years ago, and seems to have failed because it was regarded by some as an infringement of the liberties and rights of the people, or on that small share of them who wished to practise dentistry without sufficient previous study. A broader view of the question would give chief consideration to the feelings of those

who are practised upon, and it is to be hoped that this view may now prevail. Twenty-seven of our states already have laws that close the profession of dentistry to men not properly fitted for it, so that Massachusetts has become, as it were, an asylum for the unskilled, and is already flooded with them, thereby working great hardship on the educated and capable members of the profession. Good reasons against such regulation as the Massachusetts legislature is now considering, are difficult to discover.

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In the same line as this, but in a less advanced stage, is a move in Pennsylvania to allow the prescription of spectacles only to properly instructed oculists, and withhold it from opticians, whose duties end with supplying the glasses that have been prescribed. We could adduce here the same arguments that uphold the propriety of permitting none but physicians to prescribe medicines, while druggists may compound the medicines thus prescribed; while the objections to the proposition would come only from those who accept the not uncommon impression, encouraged by most opticians, that the choice of suitable glasses is not a difficult matter. This is true enough in many simple cases; but every oculist can quote examples of harmful effects following the use of lenses not adapted to the needs of the eyes. Few opticians have more than a mechanical training in their art, while the oculist should be a specialized physician. He and his patients deserve the same protection that is extended to other doctors and theirs.

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BY THE WILL of the late Uriah A. Boyden, property, the present value of which exceeds two hundred and thirty thousand dollars, was left in trust for the purpose of astronomical research "at such an elevation as to be free, so far as practicable, from the impediments to accurate observations which occur in the observatories now existing, owing to atmospheric influences." The trustees of this fund have transferred the property to the President and fellows of Harvard college, in order that the researches proposed by Mr. Boyden may be directed at the Harvard college observatory. These researches will be supported by a portion of the means of the observatory, in addition to the trust-fund itself. The establishment and general management of the proposed mountain observatory will form a part of the work done at Cambridge, where also the observations made at the new station will in general be reduced and prepared for publication.

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This donation opens a new field to astronomical activity. Heretofore the establishment of observatories has depended upon local or personal influences, which have usually confined them to the neighborhood of large cities, obviously not the best situation for astronomical work. The new observatory can be placed in what may appear, after sufficient inquiry and experiment, to be the best attainable location. Many obvious reasons suggest the selection of some place in the southern hemisphere. The southern heavens are still comparatively unknown, much as has been effected during the present century by the southern expeditions of astronomers from Europe and the United States, and by the gradual establishment of permanent observatories south of the equator. Moreover, if the present observatory of Harvard college is aided by a new station in the southern hemisphere, a scheme of work may be planned at Cambridge for the survey of the entire heavens upon a uniform plan. It is also probable that the stations combining the advantages of the greatest elevation with comparative ease of access and a climate not too severe may be found upon some southern mountains. Before the project can be executed, it will be necessary to obtain as much information as possible upon all geographical and climatic topics which may affect the establishment of the new observatory. All who have such information at command will accordingly be rendering a service to the cause of science by communicating it to the observatory of Harvard college.

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## THE INDIANA EARTHQUAKE.

THE U. S. geological survey has received information from about seventy towns within, and adjacent to, the area shaken by the earthquake of Feb. 6, 1887, in Indiana and Illinois. The accompanying map shows the derived isoseismal lines numbers 2 to 6 on the Rossi-Forel scale of intensity. The survey is greatly indebted to Prof. T. C. Mendenhall of Terre Haute for his courtesy in distributing printed letters of inquiry, and it is mainly from the replies to these letters that the data have been obtained. The only exact time-observation also was made by him with a seismoscope connected with a clock. The time he gives was $4^h\ 15^m\ 6^s$ reduced to the 90th meridian

The disturbed area embraces about 85,000 square miles, and is elliptical in shape, the major axis lying nearly east and west. It is limited to the southward by the valley of the Ohio, and was but slightly felt south of the river. The reported directions of movement are, as usual, very inconsistent and of little value. It is generally reported that two distinct shocks were felt, each of a few seconds' duration, and with a small but very noticeable interval between them. A low rumbling was also generally observed as preceding and accompanying the shocks.

With the exception of Professor Mendenhall's


THE INDIANA EARTHQUAKE.

observation, the times given are not accurate enough to be of much utility. Coseismal lines, therefore, cannot be obtained for this earthquake. The speed with which a shock travels is so great, and the area and distances, relatively speaking, are so small, that it would require numerous time-determinations of very great precision to warrant any attempt to fix the coseismals.

Mr. Everett Hayden has 'weighed' the intensities, and has plotted, with his usual care and intelligence, the isoseismals herewith given. The closed curves are neither symmetric nor co-axial, and this seems to be certainly attributable, not to uncertainties of the reports alone, but to rea asymmetry in the distribution of the force of th shocks, and to a real shifting of the axes of th figures as the elastic waves of energy spread out It is not easy to make any comparison betwee this earthquake and others which from time t time occur in the valley of the Ohio, for it is th only case since the New Madrid earthquakes o 1811–12 when definite data in sufficient quantit have been gathered which would serve as th basis of such an estimate. In a general way, i may be said, however, that the intensity of th disturbance in the central portions was, on th whole, about equal to that exerted in the souther portion of Ohio, central Tennessee, and Kentuck by the Charleston earthquake of Aug. 31, 1886.

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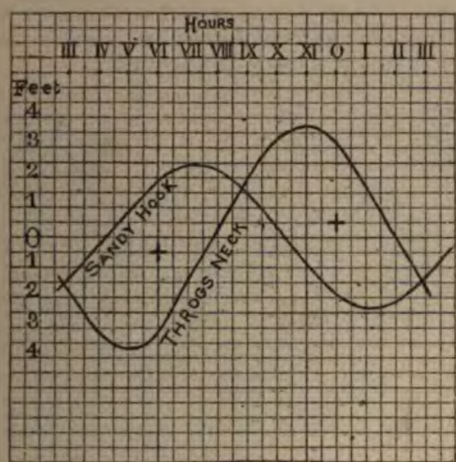
## *CIRCULATION OF THE SEA THROUGH NEW YORK HARBOR.*

Two derivations of the tide enter New Yor harbor, one by way of Long Island Sound, th other by way of Sandy Hook Bar. The one tha traverses the sound is much obstructed an 'crowded,' so that it arrives upon the scene fou hours behind the other, and much augmented i 'range.'

These two tides meet, or pass into each other, a Hell Gate, and give to the city portion of the Eas River a composite 'rise-and-fall' and a peculiarl local system of tidal currents. The general schem of this meeting and composition is to be found i the annual report of the coast survey for 1867 much as I should give it to-day, so I will no enter upon it here, but offer the accompanyin diagram as the types of the tidal profiles.

The two figures are serpentine curves whose ele ments are those of the tides given in the tables o published charts for the two entrances to Ne York. From this diagram we observe that abou three lunar hours after the moon's transit, the su face of the sound is at the same elevation as th sea at Sandy Hook. Later, they differ, and mor and more widely, till at the sixth hour a maxi mum difference of height is reached, which ex ceeds five feet. Then a decline takes plac till at the ninth hour the sound and Sandy Hoo Bay are again upon the same level. After this slope in the opposite sense develops, reaching maximum about the time of the next transit. Th first slope, that between three hours and nin is towards the sound, i.e., the sound continu through this interval to be lower than the harbo The second slope is towards the harbor, and on may remember it easily as that which reaches i maximum at the 'southing of the moon,' an creates the 'ebb-current,' so called.

Referring again to the diagram, it will be seen that the two lunes, or spaces between the type-curves, are equal, i.e., the slopes creating the flood-current and the ebb-current, alternately, are equal in amount and duration. There is the same 'head' for one stream as for the other. But there is a very important difference in the positions of these lunes, which affects materially the relative values of the slopes they represent. I have marked with a cross the centre of each, and it will be observed that the right-hand lune is one foot above the other, — which means that the ebb (westerly) current is in deeper water and greater transverse section than the flood. It is, therefore, the larger stream, and, having greater 'hydraulic mean depth,' it is at most points the quicker also. The East River is delivering more water into New




York harbor than it carries back again to the sound.

Although the Hudson and other rivers flow into New York harbor, and slightly raise its level, the conditions illustrated in our diagram are very nearly realized in the seasons when the fresh-water discharge is at a minimum. One of these seasons is the autumn ; the other is mid-winter, when the land-waters are ice-bound. At such times, the greater velocity being westward, and the greater depth of water being that of the westerly flow, there is, as a net result, a circulation of sea-water through the harbor from the sound to the ocean. In mid-winter this circulation, renewing the water before it can get chilled, and lowering the freezing-point, by mixing sea-water with the river discharge, serves to keep the port open to commerce. One may form some estimate of the value of the three or four degrees difference of freezing-points between sea and river waters, when it is remembered that in severe winters Halifax, Portland, and Boston have not closed before Philadelphia or even Baltimore.

This circulation also aids in maintaining the channels over the bar, which could not exist if the ebb and flood were equal, i.e., if there were no 'net-gain' of the sands swept to and fro ; for the bar is but a broken portion of the *cordon littoral* of which Sandy Hook and Coney Island are dry parts. Its channels are maintained by a slight preponderance of the seaward flow, as our observations distinctly show.

Another and nearly related advantage of this circulation is, that the heavier sea-water runs low, and sweeps the bed of the harbor ; whereas, were the harbor tideless, the river outflows would be superficial on reaching the basins, and these basins would in course of time fill up. This superficial flow of fresh waters on reaching the sea is a well-know phenomenon. The clear sea-water, with the full density of the ocean, may be pumped up from a few feet below the entirely fresh water of the surface at the mouths of many rivers, notably those of great discharge.

The fresh waters that enter from the Hudson and other streams play an insignificant part in the physics of the harbor ; but the circulation of the sea by way of the East River, although small in quantity, is the element which determines the superiority of New York harbor over nearly all the 'sand-barred inlets' of the world. It is this circulation which keeps the port open in winter and sweeps the sand from its threshold.

HENRY MITCHELL.

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## THE RECENT ERUPTION OF MAUNA LOA.

MAUNA LOA is again in eruption after an interval of six years since the lava-stream of 1881, which so closely grazed the town of Hilo. The present flow is on the south-west side of the mountain, entering the sea immediately north of the flow of 1868, or, rather, two miles from it. The source is about twelve miles farther up the mountain than in 1868, or twenty miles from the sea. An aneroid observation gave 5,700 feet elevation for the lower end of the fissure. The points of emission ranged for three miles along the vertical fissure, which appeared to extend some two miles higher.

On the evening of Jan. 16 a sharp jet of lava was observed shooting up from the Mokuaweoweo 'caldera' at the summit of Mauna Loa to an immense height, lasting ten minutes, with gradual subsidence. This is the common precursor of a flow from a lower point. The actual flow

began on the 18th, more than halfway down the south-west flank, as above stated. It was extremely copious, rising in several large fountains from one hundred to two hundred feet high, and reached the sea in twenty-six hours. The width of the somewhat crooked and irregular stream probably averages three-fourths of a mile, which is about its width on the seashore.

I was unable to reach the scene until Feb. 2, when it had just ceased to flow, and there remained only the hideous scoria embankment — 'monstrum horrendum, informe, ingens, cui lumen ademptum.' Until the previous night the fountain had continued to be a powerfully brilliant object, and the streaming lava conspicuous on the


slopes. Spots of glowing cinder were still to be seen on the front of the embankment, as our steamer laid by for daylight. Our tourist crowd of two hundred people landed in the morning. No difficulty was experienced in traversing the many square miles of piled scoria in any direction, except the incredible raggedness of the surface. Occasional pits or rents disclosed the fiery interior. The lava seemed to be of unusually high specific gravity, judging by samples of wave-assorted fragments on the many beaches in the coves of the sea-front. The embankment seemed to average about thirty feet in depth above the old lava of the foot-plain of two miles, tumbling over a low precipice of twenty feet, having filled out from three hundred to five hundred feet into water of thirty fathoms, along four thousand feet of shore, making about thirty acres of new land. No cinder-cones had been formed by the contact with the sea on this occasion, although six or seven such stood in the immediate vicinity, one having risen out of the sea at the flow of 1868, and immediately been united by lava to the land.

This new flow is almost exclusively *aa*, or clinker. The neighboring flow of 1868, equally sudden and copious, was *pahoehoe*, or smooth, hummocky lava. The new flow appears to abound in olivine. Unlike the eruption of 1868, which was preceded by long-continued and destructive earthquakes, there was little premonition this time, and no very serious damage was done to the large sugar-mills a few miles distant, except the rupture of one reservoir in the vicinity of the mud-avalanche of 1868. In actual quantity of lava emitted, the present is largely in excess of the other. Experienced observers in Hilo are confident that this is only a temporary intermission of flow, and that activity will speedily be resumed, with probably a *pahoehoe* flow, such having been the general history of previous large eruptions, like those of 1881 and 1855.

I desire to note particularly the presence of a heavy stationary line of dark cloud, lying precisely over the line of the whole flow from the sea to high up in the mountain. This cloud remained without change of form or position during the twenty hours of our presence in the vicinity, and served to mark the position of all parts of the flow with great precision. Although a little puffing of steam was rising along the sea, nothing but dry heat ascended from any point inland, save two very small columns of sulphurous smoke four miles up. In walking over the flow, currents of highly heated air had to be avoided, but no steam was observed, nor smoke, nor troublesome fumes of any sort. Yet a dense and massive condensation of vapor was constantly going on directly overhead. I judged the source of this vapor to be solely and entirely from the inflowing currents of air with their ordinary charge of water-vapor. These were drawn in and driven up from the immense heated surface, and, on reaching the necessary height, precipitated their contents into the dark cloud-bank, just as naturally as the sea-breeze piles its clouds daily against the mountain-flank all along that coast. It needs to be understood that the evolution of heavy cloud above lava is no positive proof that steam is rising from that lava. The inflowing air-currents may supply all the vapor seen.

A similar but smaller cloud-bank was seen resting over Kilauea's fire-lakes as we steamed past late that afternoon. On the early morning of the eruption of 1868, I observed its glow from the distance of 143 miles at Lahaina, and obtained a good altitude of the enormous cumulus-cloud of vapor rising from its heat. With due correc-

tions, this gave an estimated height of seven miles. Probably steam from the boiling sea was contributing to this cumulus. About six square miles of glowing surface were then radiating heat, all near the sea, the point of emission being only seven miles back, and 3,500 feet up. I judged, however, that the chief source of the vapor was the one above named, — inflowing atmospheric currents. That cumulus was naturally blazing with incessant lightning, visible even after sunrise at that immense distance. Some brownish smoke could be distinguished around the lowest part of the snow-white pile of cumulus. Previous to the actual outflow of 1868 an enormous emission of smoke had taken place, which densely shrouded Lahaina and the whole group for many days, objects one mile distant being invisible to us when at the thickest, and a very distinct odor of sulphur being present.

The present eruption was first announced to us at Honolulu by the pervading smoke, continuing from the 20th to the 30th of January. The smoke is evidently first discharged into the upper current, and transported far to the east-north-east before settling down into the trade wind, which brings it back upon us.

S. E. BISHOP.

## THE RIVIERA EARTHQUAKE.

THE accompanying sketch-map shows the scene of the late destructive earthquake. The centre of the disturbance was in the Italian province of Porto Maurizio and the adjoining French Departement des Alpes Maritimes. Two severe shocks in quick succession occurred on Feb. 23 at 6 A.M. They did a great deal of damage all along the coast, and were felt far inland. The heaviest loss of life and property was sustained in the district of Oneglia, 570 persons being killed and 156 injured. The villages of Diano-Marina, Diano-Castello, and Bajardo were almost destroyed. In the province of Genoa thirty-four persons were killed and thirty-seven injured, and in the Departement des Alpes Maritimes eleven persons were killed. The following reports show the extent of the disturbance: at Toulon two violent shocks were felt at 6 A.M., the first shock of fifteen seconds duration, the second of twelve seconds. The movements were from west to east. At Cannes three shocks were felt at the same hour. At Cuneo and Turin they did considerable damage. Earthquake shocks were observed in south-eastern France, Switzerland, Piedmont, Lucca, and Corsica. On Mount Vesuvius the instruments did not indicate any dis-

turbance, while those of Etna and at Catania were much agitated. The steamer Guadeloupe felt two shocks in latitude 43° 45′ N. and longitude 5° 39′ E. at 6 A.M., and a third one at 8 A.M. At Cannes and Antibes the sea fell three feet at the moment of the chief shock, and then rose six feet. The seismoscope at Washington was disturbed at 7.33 A.M. On Feb. 24, slight shocks occurred at Mentone and at Digne (Departement des Basses Alpes), and on the following day at 1.53 A.M. a shock was reported from Nice, and at 2 and 4 A.M. from Cannes.

This earthquake occurred on the large fault on the south-western side of the Apennines. A glance at the map shows the difference between the declivities of the Apennines. North of Genoa the Molasse hills gradually rise from the plains of Piedmont, forming a continuous curve, which may be observed from here to the Bay of Taranto. Inside of this continuous belt we find limestone, forming the Abruzzo, Gran Sasso, and the Basilicata. This line is interrupted in Tuscany. Still farther inside, on the west coast, and partly submerged in the Tyrrhenian sea, we find the separated *débris* of the ancient crystalline rocks. Here is the great fault between the sunken tract now occupied by the Ligurian and Tyrrhenian seas and the mountains. It is marked by the long lines of volcanoes and countries of frequent seismical disturbances. The east side of the Apennines is regularly folded: the west side is torn, and a seat of volcanic and seismic action. The folded side is convex and continuous: the opposite one is broken by faults and sunken tracts. Inside of the Apennines there are a great number of sunken tracts arranged on a long line, the curved limits of which cut far into the range of mountains: the Gulf of Genoa, Salerno, Naples, and the bay around the Lipari Islands are the centres of regions of this kind. The movements of the strata along these faults give rise to the numerous violent earthquakes of western Italy.

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## *LONDON LETTER.*

THE unsavory subject of the disposal of London sewage continues to attract much attention, and to create considerable interest. On three successive evenings the large theatre of the Institute of civil engineers has been crowded to excess to hear the discussion on papers by Messrs. Dibdin and Crimp on sewage-sludge and its disposal. The most telling speech was that of Dr. Meymolt Tidy, who, in a most incisive manner, delivered a heavy indictment against the Metropolitan board of works, on the ground, that, when forced by public opinion to do something to remedy the nuisance in the Thames, they summoned to their aid the very chemists who had previously given evidence before a royal commission to the effect that there was no sewage nuisance in the river! He ridiculed unsparingly the treatment by lime and ferrous oxide, and by sodium manganate, which had been adopted by the board, and also Mr. Dibdin's view that the ferrous oxide acted as a carrier of oxygen between the air and the sewage in which it was suspended. The idea that sewage could be 'made to pay' had done more than any thing else to restrict advances in the mode of dealing with it: such processes were like those for extracting silver out of sea-water. On another occasion the advocates of irrigation and sewage farms had their say at the Society of arts, where Dr. Alfred Carpenter gave his experiences of the Croydon sewage-farm, near London, which were very favorable. Such an opinion has especial value, as the author is well known as a distinguished sanitarian and medical officer of health. The local conditions for successful sewage-irrigation are not easily obtainable. There are, however, many places near American cities, within the knowledge of the present writer, where sewage-irrigation might be applied with the greatest advantage.

Another subject much before the scientific public at present is the employment of gas for lighting and heating. Mr. Colnaghi has lighted a small picture-gallery most efficiently by the gaslight system of Dr. von Welsbach of Vienna. The figures given are an average consumption in each burner of two feet per hour, at a pressure of nine-tenths of an inch, and an average illuminating-power of seventeen candles, or eight and a half candles per cubic foot of gas consumed. Within an ordinary atmospheric or Bunsen flame, is placed a mantle or hood of cotton net or webbing which has been previously steeped in a solution of oxides of zirconium and lanthanium. Mr. William Sugg, the well-known gas-engineer, lately gave a most successful gas-cooking demonstration, in which the non-luminous flame is abandoned in favor of the radiant heat from a luminous flame in a well-ventilated chamber. The gas-supply is regulated by a governor, and the results can be predicted to a nicety. The loss in roasting a joint is reduced from twenty-five per cent to eight or twelve. Neither the food nor the vessels containing it are touched by the flame: hence unpleasant flavors are avoided, and the whole apparatus, which is adaptable to many different culinary operations, has the merit of great simplicity. A very striking lecture, well illustrated, was recently given to the Manchester technical school, on 'Some curious flames,' by another gas-engineer, Mr. Thomas Fletcher. He strongly insisted, that, in the ab-

sence of a solid substance at a high temperature, it is impossible to cause combustion without flame, and that when a flame is used, it is impossible to make it touch a cold surface. The existence of this impassable cold zone was demonstrated by many curious experiments, and its practical consequences were pointed out. There was much of a deceptive character about the mere appearance of flame.

The New Zealand earthquake of June 10, 1886, and the destruction of the famous terraces, have lately come in for a large share of public attention; the Society of arts, the Geologists' association at their annual meeting, and the Geological society, having each recently devoted an evening to it. The readers of papers were respectively, Mr. Kerry Nichols, Mr. W. Lant Carpenter, Captain Hulton, and Mr. J. Martin. In the first two cases some marvellous photographs, taken by the search parties sent up during the eruption, were thrown on the screen. The hydrothermal character of the whole was well brought out, one striking view being that of a rent in the top of Mount Ruawhia, five hundred feet deep, six hundred yards across, and a mile and a half long, which was blown out in *three minutes*.

An unusual number of changes are in progress among the staff of the Natural history museum at South Kensington. During the past year the zoölogical department has lost the services of Mr. E. J. Miers and of Mr. J. J. Quelch, who had charge of the Crustacea and Zoöphytes respectively. The former gentleman, however, continues to do unofficial work in the museum; but Mr. Quelch has gone to Demerara as curator of the museum there. Mr. S. O. Ridley, who has done so much good spongiological work, is about to leave the museum and take orders. The geological department is also on the point of losing its two senior assistants. Mr. R. Etheridge, jun., will shortly return to the scene of his earlier scientific work in Australia, where he has received the appointment of paleontologist to the Australian museum and the department of mines at Sydney. The geological department will suffer considerably by the loss of his accurate and comprehensive knowledge of invertebrate paleontology, and his wide experience in the arrangement of fossils for exhibition. It is not too much to say that in this latter respect the British museum is far in advance of any other museum in Europe, as is universally admitted by our continental visitors; and for this result the museum authorities are very largely indebted to the care and skill of Mr. Etheridge. Almost the same may be said of Mr. W. Davies, who is about to retire on a well-earned pension, after a prolonged period of service, during which he has had charge of the fossil vertebrates. Although he has published little, he has done very much for vertebrate paleontology, both in the preparation of specimens for investigation and exhibition, and from the unselfish way in which his extensive knowledge has always been unreservedly communicated to other workers. Many important observations which are recorded in paleontological memoirs by various authors are in reality due to the work of Mr. Davies, though this fact has not always been made known by the writers of the memoirs in question.

The *Zoölogical record*, the future existence of which has been in danger of late, is now to have a new lease of life. For some time past the subscription-list has not sufficed to pay the working expenses, and negotiations were set on foot with Dr. Anton Dohrn, in order, if possible, to bring about a union of the *Record* with the later established *Zoologischer Jahresbericht*. These have fallen through, however, and so the Zoölogical society is about to undertake the publication of the *Record*. It will remain under the able editorship of Prof. F. J. Bell, who has brought out the last few volumes. These have appeared within the year succeeding that of which the literature is recorded; and in this respect the English work has the advantage of its German companion, which is, however, much more comprehensive in its scope.

Fermentation in relation to bread-making has been investigated by Mr. W. Jago, who communicated his results to a recent meeting of the London section of the Society of chemical industry. Discarding entirely the prevalent idea that the main object of the fermentation was the aeration of the bread, he described an apparatus, and the results obtained by its use, for comparing the amount of fermentation produced under the same conditions in various elements of the flour separately (e.g., gluten, starch, aqueous extract, etc.), by measuring the amount of carbon dioxide evolved from the same weights in the same periods. The ferment employed in all cases had been the pressed distillers' yeast, usually obtained from rye. It was elicited in the discussion which followed, that both the author and others were engaged in investigating the separate actions of the different kinds of ferments to be found in bakers' yeast, and, in fact, in endeavoring to put the chemistry of panifaction on the same sound basis as that recently established for the fermentation of beer. These results will be looked for with much interest.

At the same meeting the first scientific data were given about the recent English-grown tobacco. The percentage of ash was very much

higher than in either American or German tobacco, indicating that the plant had been much 'forced;' and it contained much more lime than usual in proportion to the potash and soda, as well as a high percentage of chlorine. Moreover, water extracted one-third more of soluble matter from English than from American tobacco.

It may be worth noting that this society has now nearly three thousand members, that its journal is entering on its sixth volume (published monthly under the direction of a committee), and that its aims are perfectly distinct from the Chemical society, which deals with pure science, and from the Institute of chemistry, which is mainly an association, for professional and self-protective purposes, of analytical chemists.

A paper on 'Telephonic investigations,' by Prof. S. P. Thompson, is giving rise to three nights discussion at the Society of telegraph engineers and electricians, of which the veteran Sir Charles Bright is now president. The paper, which is well worthy of attentive study, contained an almost exhaustive classification of telephonic transmitters, receivers, and transformers, — an account of the author's numerous researches thereupon, and especially of his 'valve' telephone, — and an elaborate discussion of the effect of heat in microphonic contacts. The author concluded with the following sentences, upon which the discussion mainly turned: "In conclusion, I would reiterate my conviction that the success of long-range telephony depends upon the possibility of devising instruments which, on the one hand, can be used with higher battery power to transmit stronger currents, and which, on the other hand, will be adapted to receive these currents by means of apparatus which, though not necessarily more sensitive to small currents than the present receivers, will have a higher electrical and mechanical efficiency. And I am convinced that the path of progress lies very near the road already travelled by those who have perfected the existing machinery for the electric transmission of power."

The direct opposite of this was very stoutly maintained by Mr. Preece, head electrician of the post-office telegraphs, who argued that both on theoretical grounds, — viz., that, in Sir W. Thomson's law, the value of $a$ in the equation

$$a = CKrl^2$$

was independent both of current and of electro-motive force, — and also as the result of practical experiments, a great number of which were quoted, long-distance telephony was a question, not of instruments, but of line.

At the annual meeting of the Physical society of London, held this afternoon, Prof. Balfour Stewart was re-elected president, and Dr. E. Atkinson, who for many years has been treasurer, was elected a vice-president, while Prof. A. W. Rücker (the recently appointed successor to the late Professor Guthrie at the Science schools, South Kensington) was appointed treasurer. The society adopted an alteration of its rules, whereby membership of a foreign or colonial scientific society shall in future be held equivalent to the personal knowledge, on the part of members of the society, of candidates for its membership. W.

London, Feb. 12.

## *GEOGRAPHICAL NOTES.*

### *Africa.*

The latest letter of Dr. O. Lenz is dated December, 1886. On June 30 he left Kasonge, which was being ravaged by small-pox. After he had left the village the disease broke out among his caravan, and among those who died of it were his own and Bohndorf's servants. On the 7th of August he reached the Tanganyika, where he met with the English missionaries. He crossed the lake to Ujiji, whence he wished to go north. However, on account of the war between the Arabs and northern tribes, he was unable to continue his journey, and was obliged to proceed towards the east coast. He did not follow the well-known route from Ujiji to Bagomoyo, but chose the Zambezi route. He crossed the land between the Tanganyika and Nyassa, went by boat over Lake Nyassa and down the Shire and Zambezi. Having reached Kwilimane at the mouth of this river, he embarked for Zanzibar. His arrival there was announced a short time ago.

*Le mouvement géographique* of Feb. 15 contains an interesting sketch-map of the district north of the Kongo by A. J. Wauters, showing the present state of our knowledge of the hydrography of that country according to the explorations of Junker, Grenfell, Lupton Bey, and Flegel. The Welle-Makua has been copied from a sketch furnished by Dr. Schweinfurth, and shows the important discoveries of Dr. Junker.

Stanley has left Zanzibar for the Kongo. At the same time the famous Arabian trader Tippo-Tip started for Stanley Falls, and has promised to support Stanley's expedition.

The January number of the *Bulletin* of the Paris geographical society contains an accurate map of the Ogowe in West Africa by Lieutenant Mizon, and of his return journey to the coast. In the paper which accompanies the maps, Mizon describes the methods of observation, and gives the positions of some of the more important points. The maps are on the scale of about one kilometre to an inch, and contain a great deal of topographical and orographical detail.

*America.*

The Hudson Bay company last autumn completed a steamer for the lower part of the Mackenzie River. Trial trips were made on Great Slave Lake, and next summer she will run to Peel River, near the mouth of the Mackenzie.

The Geographical society of the Pacific at San Francisco announces the recognition of the new monthly journal *Kosmos*, edited by C. Mitchell Grant, as its official organ. The new periodical will give reports on the meetings of the society. Though its plan includes all branches of science, the first number is largely devoted to geography. We find in it a description of the ascent of Mount St. Elias by H. W. Seton-Karr, and a paper by Prof. George Davidson on 'Submarine valleys on the Pacific coast of the United States.' The resuming of publications by the geographical societies of San Francisco and Mexico shows that interest in geography is increasing in America.

*Polar regions.*

Mr. Alexander McArthur, formerly an employee of the Hudson Bay company, left Winnipeg, Feb. 13, on an exploring expedition to the polar regions. He intends to go from Winnipeg to Fort Churchill, and to continue his journey along the west coast of Hudson Bay. While Gilder proposes to push north by the way of Fury and Hecla Strait, McArthur prefers to go north-west by the way of King William Land and Boothia Felix, the ill-famed districts of Ross's sufferings in 1829–33, and of the loss of the Franklin expedition. He intends to stay a winter on King William Land, and to go north in the ensuing winter, crossing Lancaster Sound, and following the west coast of North Devon. From there he proposes to cross to the little-known islands of Jones Sound and thus reach the west shore of Grinnell Land, which, he hopes, will prove a safe route north. He expects to be absent some three or four years. This plan of reaching the north pole will undoubtedly be as unsuccessful as Gilder's. Gilder has ample experience in arctic travelling, and consequently does not attempt a route that is even unknown to the Eskimos. The way he intends to go is inhabited by natives, and, under favorable circumstances, he may have a chance to reach Lancaster Sound in the spring of 1889. Whether he will be able to cross Lancaster Sound is doubtful. The Eskimos travel very rarely across this strait, and the journey can be accomplished only in favorable years when it is frozen over, which does not occur often. As steam-whalers go every year to Smith Sound and Pond's Bay, Gilder's plan cannot be considered a good one, though he might do considerable geographical and ethnological work between Fury and Hecla Strait and Pond's Bay. He will have the greatest difficulty in getting Eskimos to go along with him across Lancaster Sound. Food is very scarce on this journey, and many stories of the natives referring to families crossing Lancaster Sound are full of the horrors of starvation and cannibalism. The natives of Cape Isabella are said to be comparatively well off, and these are the only ones who can help an explorer along. We cannot see any reason why a traveller who intends to explore the extreme north should not start from the nearest available point instead of wasting his time and strength on a hazardous journey for which there is no necessity. Mr. McArthur may succeed in reaching King William Land, as there exist two or three routes to that country which are used by the natives, — one from Chesterfield Inlet, another from Wager River, and a third along the coast of the Gulf of Boothia. Rae and Hall used the last, and Schwatka the second route. As, however, the Eskimos of King William Land and Boothia do not travel farther north than Bellot Strait, and since 1833 do not even visit this part of the coast, and as they are not at all acquainted with the more northern parts of the Arctic Archipelago, there is not the slightest chance for McArthur to get along on this route. Explorers like McArthur and Gilder may accomplish considerable and valuable work when they confine themselves to a task adequate to their means and the strength of a single man, but the accomplishment of their plans is almost impossible. The exploration of Jones Sound is one of the most important problems of the geography of arctic America, and it may be accomplished by a few men at a small expense. Gilder is a man of extensive experience in travelling in the Arctic, and we may be allowed to express the wish that he should give up his present plan and apply his energies and skill to this important work which he will be able to accomplish.

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## NOTES AND NEWS.

NOT long ago Nicolaier, working in Flügge's laboratory, found a bacillus which had the power to produce in animals the phenomena of lock-jaw (*tetanus traumaticus*). Afterward Rosenbach succeeded in obtaining the same bacillus from the wound of a man who had died of lock-jaw. L. Brieger has recently prepared from flesh a ptomaine which produces in animals the same symptoms as those which are produced by injecting the specific tetanus bacillus. To the substance he gives the name 'tetanine.' He has, further, found the same substance in human cadaver which had

for several months been undergoing spontaneous decomposition. Tetanine is a definite chemical compound which can be purified by the usual chemical methods, and was so purified by the discoverer. Brieger also found in tetanus-cultures another ptomaine which has the power to produce cramps and other symptoms closely resembling those of lock-jaw. The finding of the tetanus-bacillus and of tetanine suggests an explanation of certain facts which have been known for some time. In some localities persons with wounds are particularly liable to lock-jaw. In one such locality, at least, large areas of land are covered for a part of the year with the refuse from fish-oil factories. It seems not improbable that in the decomposition of the fish the ptomaine described by Brieger may be formed, and that as the matter dries it may find its way into the air to some extent; or it may be present in the earth, and contact with the earth may cause its introduction into a wound.

— One of the most valuable contributions to science now in course of preparation is a series of charts showing the surface temperatures of the Atlantic coast waters from the eastern coast of Maine to the extreme southerly coast of Florida. This important work is being prosecuted by the U. S. fish commission, with the aid of the lighthouse board and the signal service, and is based upon observations made thus far at twenty-four lighthouse stations, showing the surface temperatures at these localities during the past five years. The temperatures at each station are shown in detail for each year by ten-day means, and these results are combined with a series of isothermal charts showing the relations of the different stations. These observations have a most important bearing on the study of the migration of the mackerel, menhaden, shad, and other migratory fishes, and will be of great value. Other temperature observations of the inland waters of the United States are now in course of reduction, and will shortly be issued.

— The prevalent belief that an Indian bears pain with perfect composure is likely to be overthrown by the observations of Dr. Corbusier among the Apache Indians. He finds that they do not endure physical pain any better than, if as well as, the whites. Great pain renders them stupid, and the stolidity with which they are supposed to bear pain is not well maintained by them under small surgical operations, even the extraction of a tooth almost always eliciting a grown or a yell. The paint which is usually on their faces conceals their expression. When this is removed, the changes induced by the emotions may be readily detected: anger is almost always betrayed by the expression of the eyes, fear by the dirty grayish color the skin assumes, surprise by suddenly drawing in a breath as if gasping, and sometimes by covering the mouth with one hand.

— The Linnaean society of New York have passed resolutions asking congress to make adequate laws for the preservation of the native animals, forests, and the many objects of wonder and scientific interest contained in the Yellowstone national park. The resolutions were presented in both houses of congress on Monday last.

— The desire has been frequently expressed for an American journal devoted to the interests of agricultural science, and several unsuccessful efforts have been made to establish one, but the modest journal under the title of *Agricultural science* (Charles S. Plumb, Geneva, N.Y.), whose first two numbers lie before us, is, we believe, the first of them which has proved viable. The purposes of the new journal, as stated by the editor, may be summarized as, first, the publication of original work in agricultural science; second, the publication of abstracts of articles in foreign journals; third, to furnish a means of communication for students and investigators in this line. In the numbers before us the two latter aims of the journal are more amply fulfilled than the first. The abstracts are well selected and prepared, and not a little news of interest is presented. The original articles are five in number, and take up twenty-one out of forty-eight pages, but only three of them contain the record of any original work, and the main points of one of these have been previously published, so that we have in the two numbers eight pages of fresh, original investigation. This fact seems to us to show plainly one of the chief difficulties likely to beset the editor, viz., a paucity of original investigations. The amount of original scientific work performed at the various agricultural colleges and experiment stations is not large, and considerable of what is done seems likely to find its final and only means of publication in annual reports and the like. At the same time, we wish the new journal all possible success. The attempt is certainly a most laudable one, and the execution thus far praiseworthy. Whether the two obstacles of paucity of material and a necessarily somewhat limited number of readers can be overcome, time must show.

— The publication agency of the Johns Hopkins university has now ready for issue vol. i. of a series of selected morphological monographs by members of the university, under the editorial direction of W. K. Brooks, Ph.D. The volume contains three hundred and seventy pages and

fifty-one plates, quarto. The contents are, 'Lucifer: a study in morphology,' with eleven plates, by W. K. Brooks; 'The development of Renilla,' with sixteen plates, by E. B. Wilson; 'The life-history of the Hydro-Medusae: a discussion of the origin of the Medusae, and of the significance of metagenesis,' with eight plates, by W. K. Brooks; 'Report on the Stomatopoda,' with sixteen plates, by W. K. Brooks. Only one hundred copies in all will be issued. The price is fixed at seven dollars and fifty cents net, delivered by mail, postage paid, or by express at the expense of the purchaser.

— The Smithsonian institution has received notice from Col. J. H. Wood of St. Paul that he has shipped to them the bodies of five persons — a man, woman, and three children — taken from a cave in the Bad Lands of Dakota by a miner. The bodies are simply dried up, and are not petrified, but are in a remarkable state of preservation. Scientific men who have seen them say they belong to a race which existed two thousand years ago. This will be a very important addition to the collection of desiccated bodies now on exhibition in the national museum.

— Dr. Baker, secretary of the Michigan state board of health, has found that in that state small-pox has been comparatively epidemic every five years. In 1872 there were 302 deaths from that disease, in 1877 there were 102, and in 1882 there were 100. He looks for its appearance in the state again this year.

— The statement is made that supernumerary toes and fingers are very often met with among the negro tribes living beyond the Orange Free State. Dr. Stoekly mentions the case of a Caffre, eighteen years old, who had six fingers on each hand. His father, mother, four sisters, and a brother had the same. His mother had also a double series of toes on both feet.

— The January meeting of the Michigan state board of health was especially noteworthy by reason of a report of a special committee which had been appointed to confer with the regents of the university relative to the establishment of a laboratory of biology and hygiene at that institution. As a result of the agitation of the subject, the legislature of the state has been memorialized to establish such a laboratory.

— An unnamed fever is said to be very prevalent in Jerusalem, the patients being so numerous as to fill a large hospital camp. As quinine is said to be greatly in demand, we presume the fever is of malarial origin. It is thought that the spread of the disease is due largely to polluted drinking-water and unwholesome food.

— Reference was made in a recent number of *Science* to the deaths which occurred in January of the present year in the city of Troy, N.Y., from the inhalation of fuel-gas. The *Medical news* contains a history of these cases from the pen of Dr. Bontecau, who assisted at the autopsies held on the victims, and attended others who recovered. The occupants of a row of dwellings were almost all seriously overcome by the gas. When the cause was discovered, the police aroused those who lived in these houses, many of whom were found sick. All the occupants of one flat were dead. At the autopsies the solid tissues and the blood were found to be of a cherry-red color, which is characteristic of poisoning by carbonic oxide. The composition of the fuel-gas which was used in these houses is said to be, hydrogen 56, and carbonic oxide 44, parts in 100.

## LETTERS TO THE EDITOR.

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### On certain electrical phenomena.

IN *Science* of Feb. 18, Dr. Shufeldt relates some interesting instances of accidental electrification. He seems to imply, in his description of the phenomena, that there is something mysterious or unusual in such occurrences. If he will critically examine his facts, possibly eliminating a few of them, I think he will find nothing which is not easily accounted for, and which has not been long recognized. I have amused myself and many of my friends with this sort of thing for many years. The electrification of a man or a woman in moving about a room is a phenomenon in which the individual is not to be counted, as it depends entirely on the conditions existing at the time. Everybody is 'susceptible' if the conditions are favorable. As Dr. Shufeldt states that he had never observed such exhibitions in Washington, I may remark that in two different houses in which I lived in that city I observed them on innumerable occasions. In one of these I arranged a couple of bent wires in such a way that the spark passed between them directly over the opening of a gas-burner, and for several weeks matches were a useless luxury. In another house that I know of, dancing-parties were especially gotten up by the young people, that they might be amused by the passage of the spark in touching hands. In the latter instance the phenomenon was strongly marked during nearly all of a continuously cold winter. During the present winter, in the house which I now occupy, accidental electrification has several times reached such a point as to be positively disagreeable. In moving across a room to turn a water-faucet, or to touch a poker or any other fairly good 'ground,' a long spark and an uncomfortably strong shock would result. But this was confined to no person or persons; any one who happened in was affected in the same way, provided the conditions were equally favorable.

The necessary conditions are simply those which are required for the successful performance of any

experiment in 'frictional electricity' — so called. Given a house heated by a hot-air furnace or by steam, a floor covered with soft carpet which, in virtue of the furnace heat, is dry and warm, a man the soles of whose shoes are thoroughly dry, and electrification will probably result from every brisk movement of the man over the carpet. These conditions are most likely to be met with during cold winter weather, and it is then that the phenomena are generally noticed. It is not probable that Dr. Shufeldt's two friends can perform the feat of lighting gas in this way 'at all times and under all circumstances.' His statement that the "electrical discharge was considerably greater from the tip of the index finger than from any of the others of the hand, and gradually diminished in regular order as we proceeded to the little finger," is interesting, but needs confirmation. I am sceptical as to the charging of his entire system 'with this animal electricity,' and the results which followed such a condition, and particularly so as to the origin of the "sense of the most profound relief, as if it were that all the electricity of my system had been completely withdrawn by the act," which he experienced when his hand touched the back of the young mulatto girl. Is man one of the extremely small number of animals having specialized electrical organs? T. C. M.

Terre Haute, Ind., Feb. 22.

## Inertia-force.

The importance of clear elementary ideas on the teaching of dynamics justifies me, I think, in asking space for a further discussion of Dr. E. H. Hall's 'inertia-force.'

In his letter published in *Science* of Feb. 18, Dr. Hall expresses the opinion that our difference with regard to 'inertia-force' is based upon a difference of interpretation of the term 'force.' That, I think, is not the case. With all his statements as to force in general I agree; and the passage which he quotes from Maxwell, as expressing his view of force with sufficient accuracy, expresses also my view with complete accuracy. Dr. Hall, indeed, says that this passage meets many of the points raised by me; and it would thus seem that it must be inconsistent with many of my positions. But I am unable to detect the inconsistency, and Dr. Hall merely asserts it without giving any proof.

I am in full agreement also with Dr. Hall, not in opposition to him as he supposes, when, passing from force in general to a particular case, he says that a ball swinging in a circle at the end of a string acts upon the string with a force directed from the centre. The ball certainly does exert such a force. I think it misleading to call that force centrifugal force, as he and many writers do; but that the force which he calls centrifugal force is an actual force is undoubted.

But when Dr. Hall proceeds to expound his 'inertia-force,' we seem to part company, perhaps because he has not given a complete specification of this force. He has told us its magnitude and its direction, but its place of application, the body on which it acts, he has left us to infer from the context, and my inference he calls in question. It would be useless for me to justify my inference, because in Dr. Hall's letter he modifies the statement of the pamphlet from which it was drawn, saying that what he meant was that "the inertia-force works [or acts] with the smaller applied force *against the agent which* exerts the greater force." From this modified statement I could not, of course, have made the inference referred to, — in fact, I could have made no inference at all; for it is couched in language which is not the current language of dynamics, which is not defined, and which I must confess I do not understand.

Let us, however, take Dr. Hall's new illustration, and see what light that throws on the place of application of inertia-force. "A train is being started by a locomotive. The forces *applied* to the train are the pull of the locomotive, and the smaller, opposing, force of friction. The pull of the locomotive prevails, but in prevailing it must deal not only with the resistance due to friction, but with the reaction (which also I call resistance) due to the inertia of the train," in other words, the inertia-force. Here, again, Dr. Hall uses terms not current in dynamics, and I do not understand what he means by the locomotive 'dealing with' both the frictional resistance and the inertia-force. Whatever may be the exact meaning of that phrase, however, it seems clear that if the inertia-force acts on the train, and if the pull of the locomotive has to deal with this force in moving the train, it must be expected to have some effect on the motion of the train. Yet if $F$ is the pull of the locomotive, $R$ the frictional resistance, $M$ the mass of the train, and $a$ its acceleration, we have undoubtedly, by Newton's second law of motion,

$$a = (F - R) \div M;$$

and hence the inertia-force is quite without effect on the motion of the train. It would seem, therefore, that the inertia-force cannot act on the train. Does it then act on the locomotive? If so, it can only be the force which the train exerts on the locomotive, which is of course equal and opposite to the above force $F$. But it cannot be this force; for if the brakes be put on the train, though the pull of the locomotive on the train — and therefore the force exerted by the train on the locomotive — may be kept constant, the acceleration of the train will change; and, according to Dr. Hall, the inertia-force must be proportional to this acceleration. Thus even this new illustration does not enable us to determine on what body the inertia-force acts.

This difficulty in determining the place of application of the inertia-force would be at once accounted for if it should be found to have no place of application at all, and I strongly suspect this to be the true conclusion. Dr. Hall seems to me, in fact, to have postulated a hypothetical force to account for the supposed resistance of a body to the action of an applied force, and to have thus fallen into the error referred to by Poisson in the following sentences: —

"Concevons qu'un corps soit posé sur un plan horizontal, et qu'il n'y soit retenu par aucun grottement. Si je veux le faire glisser sur ce plan, il faudra neanmoins, à cause de l'inertie de la matière, que j'exerce un effort quelconque. . . . J'aurai, dans chaque cas, le sentiment de l'effort que je serai obligé de faire; mais je ne devrai pas en conclure que la matière oppose aucune résistance à cet effort, et qu'il existe dans les corps ce qu'on appelle très improprement une *force d'inertie*. Quand on s'exprime ainsi, on confond la sensation que l'on a éprouvée, et qui resulte de l'effort qu'on a exercé, avec la sensation d'une resistance qui n'existe réellement pas" (*Traité de mécanique*, tome i. § 120). J. G. MACGREGOR.

Halifax, N.S., Feb. 22.

## Calendar of Societies.

*Philosophical society, Washington.*

*Feb.* 26. — C. V. Riley, Our city shade-trees, their foes and their future; L. F. Ward, Frequency of coincidences; G. E. Curtis, The theory of the wind-vane.

*Institute of social science, New York.*

*Feb.* 24. — Robert Collyer, D.D., The labor question.

*Natural science association, Staten Island.*

*Feb.* 12. — Mr. Hollick, The size and probable age of a number of our trees.

*Society of arts, Boston*

*Feb.* 24. — E. D. Peters, Bessemerizing of copper mattes.

*Appalachian mountain club, Boston.*

*March* 1. — C. D. Walcott, A trip to the Grand Cañon of the Colorado.

*Boston society of natural history.*

*March* 2. — C. D. Walcott, A trip to the Grand Cañon of Colorado; J. H. Emerton, Restoration of a skeleton of Dinoceras.

*Brookville society of natural history, Brookville, Ind.*

*Jan.* 11. — Isaac Carter, Observations on the development of Kansas; J. F. McKee, Local alluvial deposits; J. C. Shirk, Notes on the opossum; R. M. King, Some difficulties attending the rescue of Emin Bey.

*Feb.* 8. — A. W. Butler, Further notes on the opossum; E. R. Quick, Examples of albinism among American mammals, with exhibition of specimens.

*Feb.* 8, *election of officers.* — President, C. F. Goodwin; vice-president, E. R. Quick; secretary, A. W. Butler; corresponding secretary, R. M. King; treasurer, Fielding Berry.

### Publications received at Editor's Office, Feb. 21-26.

CROSBY, W. O. Tables for the determination of common minerals chiefly by their physical properties, with confirmatory chemical tests. Boston, J. A. Crosby. 71 p. 8°.

GAGE, S. H. Notes on histological methods. Ithaca, Andrus & Church. 56 p. 8°.

—— Notes on microscopical methods. Ithaca, Andrus & Church 32 p. 8°.

JANET, P. Histoire de la science politique dans ses rapports avec la morale. 3d ed. Parts i. and ii. Paris, Baillière. 608+779 p. 8°.

KOSMOS. An eclectic monthly journal of nature, science, and art. San Francisco, Kosmos publ. co. Vol. i. No. 1, February. *m.* 8 p. 4°. $3.

LANGLEY, M. Sur les spectres invisibles. Tr. by M. Charles Baye. Paris, Gauthier-Villars. 74 p. 8°.

LECLERCQ. J. Une visite au volcan de Jorullo (Mexique). Paris, Soc. de géog. 19 p. 8°.

PEALE, A. C. Mineral waters. (U. S. geol. surv.) Washington, Government. [8] p. 8°.

RANDALL, J. S. Minerals of Colorado. Georgetown, Courier pr. 49 p. 12°.

RANKE, J. Allgemeine naturkunde: Der Mensch. Lief. 61-72. Leipzig, Bibliographische institut. [565] p. 4°. (New York, Westermann.)

## Advertised Books of Reference.

ANNALS OF MATHEMATICS. Edited by Ormond Stone and William M. Thornton. Office of Publication: University of Virginia. $2 per vol. of 6 nos.

THE STANDARD NATURAL HISTORY. By all the leading American scientists. Edited by J. S. Kingsley, Ph.D. Vol. I. Lower Invertebrates. Vol. II. Crustacea and Insects. Vol. III. Fishes and Reptiles. Vol. IV. Birds. Vol. V. Mammals. Vol. VI. Man. 6 vols., nearly 2,500 illustrations and 3,000 pages. Imp. 8vo, cloth, $36.00; half morocco, $48.00. S. E. Cassino & Co. (Bradlee Whidden), Publishers, Boston.

THE BUTTERFLIES OF THE EASTERN UNITED STATES. For the use of classes in zoölogy and private students. By G. H. French, A.M. Illustrated by 93 engravings and a map of the territory represented. Large 12mo. Cloth. $2.00. J. B. Lippincott Company, Pubs., Philadelphia.

LIPPINCOTT'S BIOGRAPHICAL DICTIONARY. A new, thoroughly revised, and greatly enlarged edition. A universal pronouncing dictionary of biography and mythology. Containing complete and concise biographical sketches of the eminent persons of all ages and countries. By J. Thomas, M.D., LL.D. Imperial 8vo. 2550 pages. Sheep. $12.00. J. B. Lippincott Company, Pubs., Philadelphia.

INSTRUCTION FOR THE DETERMINATION OF ROCK-FORMING MINERALS. By Dr. Eugen Hussak, Privat Docent in the University of Grau. Translated from the German by Erastus G. Smith, Professor of Chemistry and Mineralogy, Beloit College. With 103 plates, 8vo, cloth. $3.00. John Wiley & Sons, Pubs., Astor Place, New York.

INSECTS INJURIOUS TO FRUITS. By Prof. William Saunders, F.R.S.C. Handsomely illustrated with 440 wood engravings. Crown, 8vo. Cloth. $3. J. B. Lippincott Company Pubs., Philadelphia.

WILSON. — AMERICAN ORNITHOLOGY; or, The Natural History of the Birds of the United States. By Alexander Wilson. With a life of the author, by George Ord, F.R.S. With continuation by Charles Lucien Bonaparte (Prince of Musignano.) POPULAR EDITION, complete in one volume with 385 figures of birds. Imp. 8vo. Cloth, $7.50. Half Turkey mor., $12.50. Porter & Coates, Philadelphia.

GEOLOGY, CHEMICAL, PHYSICAL, AND STRATIGRAPHICAL. By Joseph Prestwich, M.B., F.R.S., F.G.S. Correspondent of the Institute of France, Professor of geology in the University of Oxford. In two vols. Vol. 1.: Chemical and Physical. 8vo. $6.25. (Oxford University Press.) Macmillan & Co., Pubs., New York.

PHYSIOLOGICAL BOTANY: I. Outlines of the Histology of Phaenogamous Plants; II. Vegetable Physiology. Goodale (Harvard), 8vo., 560 pp. $2.30. Ivison, Blakeman, Taylor & Co., Pubs., New York.

HOURS WITH THE BIBLE, or the Scriptures in the Light of Modern Discovery and Knowledge. By Rev. Cunningham Geikie, D. D. The series covers the whole of the Old Testament. 6 vol. 12°. Cloth, with illustrations and index. Sold separately, and each complete and distinct in itself. $1.50 per vol. James Pott & Co., Pubs., New York.

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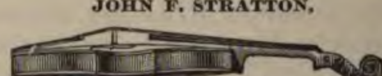

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# SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 4, 1887.

## *THE MAGNETIC AND TIDAL WORK OF THE GREELY ARCTIC EXPEDITION.*

It is well known that the expedition sent out by the government to Lady Franklin Bay in command of Lieut. A. W. Greely, U.S.A., was one of two expeditions to co-operate with and form part of the physical explorations proposed by the International polar commission. By invitation of its president the late General Hazen, chief signal officer, accepted the organization and fitting-out of two parties, one, under Lieutenant Greely, to proceed to the shores of Lady Franklin Bay, Grinnell Land, the other, under Lieut. P. H. Ray, to go to Uglaamie, Point Barrow, Alaska. While the general responsibility, the supervision, the accounts, the selection of men, and their transportation to and from the stations, remained in his own hands, General Hazen requested and received the aid of the coast and geodetic survey in the special departments of terrestrial magnetism, of tides, and gravitation. The assistance of the survey by its then superintendent, Capt. C. P. Patterson, consisted in furnishing such instruments as could be spared from its limited supply, in training the observers for their work, and in providing them with the necessary instructions and forms of record for the proper performance of their duty. It so happened that congress had already (in 1880) authorized a scientific expedition to Lady Franklin Bay, but the funds were appropriated so late in the spring of 1881 that it was found impossible to procure the needed special instruments and to give that thorough training to the corps of observers which could only be attained by ample time for preparation. Indeed, the commission itself found it expedient to start other expeditions a year later, in order to obtain better organization of the scientific labor, and especially for the construction of suitable magnetic differential instruments.

There is no need of referring here to the general history of the two American expeditions, as we already possess the official publication of the one under Lieutenant Ray, and the narrative of the Lady Franklin Bay party, in two handsome volumes, by its leader, Lieutenant Greely. By his permission we are enabled to lay before the readers of *Science* the general results of his labors during 1881–84 in the domains of terrestrial magnetism and of tides. They are extracted from the manuscript now ready for the printer, but it is not our intention to enter minutely into any details, which would be here out of place, nor to forestall the judgment of scientists on the merits of the work: this must be reserved for a time after the official publication and when the results by the several international expeditions can be compared and collated. A brief statement of facts so far as they relate to that part of the work which was intrusted to the special direction of the U.S. coast and geodetic survey, is all we propose to give at present.

The astronomical and magnetic work of the expedition was placed in special charge of Sergeant Edward Israel, who unfortunately was one of those not permitted to return, but whose records abundantly testify to his faithfulness and painstaking industry. Copies of these records in a highly condensed form were safely brought home, and were placed in the hands of C. A. Schott, assistant, coast and geodetic survey, for discussion and for preparation for the press. This task was rendered somewhat difficult from want of additional explanation on the part of the observer: fortunately Lieutenant Greely took the precaution, when retreating from his station in 1883, to bring with him the magnets and pendulum, thus permitting certain supplementary observations to be made at home. This cannot be too highly commended, when we consider that every pound of dead weight carried necessitated leaving behind so much food to sustain the life of the party on their perilous retreat. In judging of the merits of the labors of the expedition, it should be borne in mind that all efforts had failed to succor this party, which occupied the northernmost station assigned to any of the expeditions, and that, at the time of its sailing, certain magnetic instruments needed for fully carrying out the programme adopted by the international commission could not be obtained.

The magnetic observatory at Fort Conger was erected a short distance from the main house, and was supplied with a new magnetometer made by Fauth & Co. of Washington, and with a dip circle of the Kew pattern, but it had no differential instruments. The observations were made on Göttingen mean time, which differs $4^h\ 59^m$ from local time and $5^h\ 48^m$ from Washington time. A small transit, loaned by the survey, served for the determinations of time and longitude. The observations for time and latitude were made by means

of the sextant, and comparisons of chronometers were made throughout the stay of the party. From a series of observations of double altitudes of the sun (near lower transit), and of circum-meridian altitudes of the sun (upper transit), the latitude was found to be 81° 44′ 00.″ 4 ± 5.″4. The azimuth of the mark for absolute declination was determined on three days from observations of the sun with a theodolite, viz., 44° 44′.3 ± 0′.8 east of south. The longitude of the station from Greenwich was determined by means of ships' chronometers on the outward trip, and at the station by observations of moon culminations, occultations, and lunar distances, with the result $4^h$ $18^m$ $53^s.3$ ± $1^s.2$ west of Greenwich.

The accuracy of this result is mainly due to a fine series of seventeen moon-culminations. In arc, the longitude is 64° 43′ 50″ W., and the value preliminarily adopted by Lieutenant Greely for the use of his party was 64° 45′ W., on the authority of Lieutenant Archer, R.N., as the result by the British expedition to this place in 1875–76.

During the first ten months of the occupation of the post a series of hourly observations of the declination were made on three days in each month: this comprises the period from Aug. 1, 1882, to Aug. 31, 1883, and includes 846 observations, with a resulting declination 100° 13′.6 west of north. The results of the diurnal variation of the declination are stated as follows: on the yearly average the needle reached its extreme westerly deflection between $3^h$ and $4^h$ P.M. (local time), amount 45′, and its extreme easterly deflection between $0^h$ and $2^h$ A.M. (local time), amount 40′, hence the diurnal range 1° 25′. The diurnal variation is illustrated by a diagram.

The series of hourly observations of the declination at Fort Conger began with July 1, 1882 and ended with Aug. 1, 1883; this is the period which was assigned by the international commission to be that of close and simultaneous co-operative magnetic work obligatory on all parties. The differential measures of this series were converted into absolute values; the tabulation and discussion of this series constituted the greater part of the labor expended on the observations. The method of separating the so-called disturbances from the general record, and their treatment when separated, was left, apparently, by the Vienna conference to the discretion of each individual party, though several methods were proposed. It is well known that there is no certain criterion of what constitutes a disturbance, and, moreover, processes that may answer in lower latitudes will be found difficult of application for stations in high magnetic latitudes. It would take too much space to explain here this rather technical subject: it may be sufficiently described, however, by stating that the mean deviation of an observed value from its respective hourly and monthly normal value was first made out. Then, according to Dr. Lloyd's rule, one and a half times this value, or, in the case of Fort Conger, 1° 06′ was considered the limiting value, and any observation differing by this or a greater amount from the normal value was designated 'a disturbance.'

These hourly normals and (larger) disturbances were tabulated and the results were discussed. The average declination from this series is 100° 34′.5 W., and when compared with the earlier result of the British expedition gives 9′.9 as the most probable value for the annual diminution of west declination at this place. It is shown that the effect of the presence of these (larger) disturbances was to diminish the declination by 2′.3, and that the diurnal range of the motion of the needle was increased by their influence.

The solar-diurnal variation of the declination is presented in tabular and analytical form as well as by a diagram: its most characteristic feature is the occurrence of the westerly extreme soon after local noon, with a deflection of 37′.9, reached earlier in summer and later in winter. The opposite extreme is reached an hour and a half after midnight, with a deflection of 27′.9, also found variable with the season. Average diurnal range, October to March, 0° 56′, and April to September, 1° 22′. In the annual variation of this average range. December exhibits the minimum of 28′, and June the maximum of 1° 48′. The lowest reading on record was on Nov. 16, 1882, at $8^h$ $35^m$ A.M. (Göttingen time), when the declination was 92° 51′.6 W., and the highest reading on the day following at $10^h$ $20^m$ P.M. (Greenwich time), viz., 113° 19′.8 W., showing a change of no less than 20° 28′.2 within thirty-eight hours; and it is noted that a great magnetic storm was raging between Nov. 13 and Nov. 19, 1882, which culminated in intensity on the 17th.

The total number of hourly observations during the year was 8,749, and the number of (larger) disturbances separated from them, 1,169; in other words, there was one (largely) disturbed observation in every eight.

The distribution of the disturbances in the diurnal and annual periods, with separation into easterly and westerly disturbances, was then analyzed and the results were tabulated, with respect to both frequency and magnitude. But for want of space we cannot follow out all the results presented. We may, however, mention the following: during the year (ending Aug. 1, 1883), the easterly disturbances exceeded in number the westerly ones in the proportion of 661 to 508, or

of 1.30 to 1: in the annual variation the disturbing force was most active during November and least during September. In the diurnal variation the easterly and the westerly disturbances follow different laws as to frequency and amount. The disturbing force deflecting the north end of the needle towards the (magnetic) east is most active two hours after midnight and least active during the hours 12 to 17 (or afternoon hours). On the other hand, deflections to the west appear most frequent three hours after noon and least about the hours near midnight. Respecting intensity of action, easterly disturbances slightly exceed westerly ones.

The term-day and term-hour observations extend over the interval from July 1, 1882, to Aug. 1, 1883. They were made on the 1st and 15th of each month, when the declination magnet was observed every five minutes throughout the twenty-four hours, simultaneously at all stations taking part in the research. Besides these, observations were made every twenty seconds during one selected hour on each of the term-days. The labor bestowed upon this part of the work was very great, but it is expected that correspondingly valuable results may be deduced by their inter-comparison after all the expeditions shall have published their observations. Not content with these labors, the magnetic observers also recorded the motion of the needle during magnetic storms and in connection with appearances of auroras.

The usual observations of oscillations and deflections were made for the determination of the magnetic intensity: the record and computations are given in detail and the results are tabulated and expressed in British, Gaussian, and C. G. S. units, or dynes. For the epoch 1882–84 the horizontal component of the magnetic force was found 1.118 British units, or 0.05155 dynes, and it would appear from comparison with the results found by the British exploring expedition, 1875–76, that this intensity did not undergo any perceptible change during the interval. The tabular values show extreme variations of about one-fiftieth part of the force.

Hourly observations of the dip were made between Sept. 25, 1882, and June 1, 1883. These were in a measure differential, and resulted in an average dip of 85° 01′. Combining with the horizontal component, the total intensity as observed at Fort Conger becomes 12.870 British units, or 0.5934 dynes, for the epoch 1882.2. By comparison it was found that the dip had been increasing since 1875–76 at an annual rate of 1′.6.

The dates of auroral displays are next enumerated, and extracts are given of the character of the more imposing auroras. Then follows a table of magnetic results, collected during explorations by different parties, and extracted from Lieutenant Greely's narrative. The paper concludes with a general collection of magnetic results obtained from the expeditions of Kane, 1853–55, of Hayes, 1860–61, of Hall, 1871–73, of Nares, 1875–76, and from Lieutenants Crosby and Sebree of the Bear and Thetis in 1884. From these observations it is concluded that for the last twenty-five years, at least, the magnetic west declination has been annually decreasing about 6′ in the region of the North Water, Smith Strait, and Kane Basin, and that in the region to the north of it, and including the Hall Basin, this decrease was fully 10′ per year during the past decade.

In close connection with the scheme of physical researches undertaken by the International arctic committee, the desirability of a new determination of the American pole of dip does not appear to have been urged. It must be admitted that the region is difficult of approach; yet the gain to our knowledge of terrestrial magnetism and its secular changes would be very certain if it could be successfully explored. More than half a century has elapsed since Ross made his memorable and bold dash to this point, but science nowadays will demand more, and the whole region in that vicinity would have to be surveyed in order to permit the tracing out of isoclinics or the application of a suitable analytical process to bring out the facts of the case, as, in consequence of local deflections, there may be many points of vertical dip covering or distributed over a considerable area.

From the time of Hansteen, early in this century, to the present time, efforts have been made to trace out the supposed motion of the intersection of the so-called magnetic axis with the surface. While some physicists hold it to be fixed in position, others believe it to have a slow secular motion of limited extent, and still others would give it a rapid motion with a path which will carry it clear round the geographical pole.

The time has certainly arrived when in this matter facts should take the place of speculation. The writer has the assurance of the willingness of three distinguished American Arctic explorers to undertake this task, only the one thing lacking is the necessary funds to sustain the explorer, say for two years.

There is surely here a fine field open in which to gain well-merited distinction. C. A. S.

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A NEW departure has been made by the U. S. coast survey by way of experiment, in the publication of a chart on Mercator's projection, extending from New York and embracing Nantucket shoals.

### COMPARATIVE TAXATION.

IN the last of two articles, entitled the 'Relative strength and weakness of nations,' which appeared in the February number of the *Century magazine*, Mr. Edward Atkinson treats of the burden of taxation in various countries, and makes an estimate of the "relative proportion of the assumed product per capita which is absorbed by national taxation only." It will be noticed that Mr. Atkinson confines himself to national taxation, including under that head, presumably, the taxes of the individual German states, as well as of the empire. Such a comparison may be of value, but it is evident that it can afford no criterion of the comparative burden of taxation in the various countries unless national taxes should form, approximately at least, a like proportion of the total taxes in each. As a matter of fact, the relative proportions of national and local taxes vary greatly with the different countries, local taxes being a much more important element in the United States than in the countries of Europe. In the latter, especially in the case of such centralized governments as that of France, revenue derived from national taxation is employed for purposes which here come under state or local jurisdiction. Therefore, though we should admit, as Mr. Atkinson maintains, that national taxes absorb a smaller proportion of the product in this than in other countries, it would by no means follow that the burden of taxation was lighter in the United States than in European nations. Mr. Atkinson would nowhere seem to affirm this conclusion, but his statements are misleading, from the fact that he neglects the consideration of the very important element of local taxation, — the only reference to the question tending to add to the wrong impression, — for he says, in speaking of what proportion of the total product is left to the producer after the deduction of national taxes, "In considering these remainders after national taxes have been set off, it must be borne in mind that municipal taxation as well as profits doubtless take a larger proportion in the poorer countries than in the richer ones."

In addition to his neglect of local taxation, Mr. Atkinson appears to have made another important oversight in failing to take into consideration the difference in the methods of obtaining revenue which exists among the various countries. In the United States, government depends almost entirely upon taxation for its support, but many of the European nations derive a considerable portion of their revenue from the profits on public undertakings, such as the telegraph, railroads, public domains, mines, etc. In the *Deutsche Rundschau* for January, 1885, Professor Richard von Kaufmann makes the following estimate of the proportions of receipts which come from taxes in the countries mentioned: —

| | Percentage of receipts from taxes. | Percentage of receipts from other sources. |
|---|---|---|
| Germany (empire and states) | 41 | 59 |
| Italy | 69 | 31 |
| Austria-Hungary | 71 | 29 |
| Russia | 79 | 21 |
| Great Britain | 82 | 18 |
| France | 88 | 12 |

Mr. Atkinson appears to have substituted total revenue for receipts from taxes, for otherwise it is impossible to understand how he can have obtained the figures which he gives. He estimates the per capita national taxation in the countries given as follows: United States, not over \$6; Italy, \$10.42; Holland, \$10.90; Belgium, \$11; Great Britain, \$11.80; Germany, \$12; France, \$18.

It is interesting, in comparison with the above, to make an estimate taking into consideration local taxation and the distinctions in the sources of revenue, which will show the average per capita tax paid by a citizen of New York and Berlin respectively for all purposes, local, state, and national or imperial. The following statement is based on the 'Almanach de Gotha' for 1886, a statement of the Berlin budget for 1886-87 which appeared in *Bradstreet's* for March 20, 1886, and the report of the comptroller of the City of New York for 1884.

While these sources do not correspond exactly in time, they will afford results very nearly true. The per capita national tax in the United States, which Mr. Atkinson says does not exceed \$6, is placed at \$5.50, and the population of New York is estimated at 1,350,000. In Berlin the taxes are as follows: —

| | |
|---|---|
| Imperial tax (exclusive of state contributions) | \$ 2.03 |
| Prussian tax (including contribution to the imperial treasury) | 3.44 |
| City tax | 5.35 |
| Total | 10.82 |

The owner of a house connected with the sewage system is charged one per cent on the income from the house, which payment amounts to about

thirty-five cents per capita. In New York the taxes are as follows: —

| | |
|---|---|
| United States tax | $ 5 50 |
| City tax (including state tax) | 19.92 |
| Total | 25.42 |

The citizen of New York pays nearly two and one half times as much as does the citizen of Berlin.

Mr. Atkinson estimates the per capita product of the United States at $200, and that of Germany at $100: thus, although no estimate on a question of this kind can make any pretensions to accuracy, on the basis adopted by Mr. Atkinson, not only a larger amount per capita but a larger percentage of the product is absorbed by taxation in New York than in Berlin. The reason is that in Germany the city and state together derive more than half of their revenue from the profits of productive undertakings, and by superior methods of administration have greatly reduced the cost of government.

In Berlin, out of a total revenue of $13,754,593, only $7,042,014 comes from ordinary taxes. The profit on public works, particularly the gas and water works, amounts to $1,325,419 in excess of payments made for the amortization of and interest on the first capital. Payments of a percentage of gross receipts by such private monopolies as street-railways and gas-companies are other sources of revenue, as is also a charge of $23.80 for scholars in the higher schools. Payments by monopolies and scholars are taxes, yet they do not bear upon the citizens in general in any thing like the same proportion as do ordinary taxes, and, in a question of the burden of taxation, distribution is a very important factor. The neglect of the local element must also cause us to question Mr. Atkinson's conclusions in regard to the comparative amounts of debt. For instance, he places the per capita debt in the United States, including state debts, at $27, and in Germany, including kingdoms and duchies, at $39: but the debt of New York on Dec. 31, 1884, was $126,871,138, or $94 per capita, while that of Berlin is $36,965,767, or $28 per capita; and in addition to this it must be remembered that in Germany both states and cities own large amounts of productive property, the value of such property, in the case of Prussia at least, being more than equal to the state debt.

While it would not be fair to argue from the comparative condition of New York and Berlin to the comparative condition of the United States and Germany as a whole, still the city, as a centre of production, is an element of great and growing importance, and in estimating the comparative burdens upon producers in this and other countries more valuable results will be obtained by considering those who work, as near as may be, under the same conditions in the various countries, than by taking the average for whole populations.

The figures for other countries than Germany are not at hand, but the same considerations would modify Mr. Atkinson's results in all cases, though probably to a less degree than in Germany.

The neglect of these three points — local taxation, profits from public undertakings as a source of revenue, and administrative methods as an element in the cost of government — has in large measure destroyed the value of Mr. Atkinson's work as a comparative study.

HENRY B. GARDNER.

## A DISCUSSION ON ARSENIC POISONING.

A VERY interesting and instructive discussion took place at a recent meeting of the Suffolk district medical society on the subject of poisonous arsenical wall-papers. Dr. J. R. Chadwick described an experience which he had in his own family, in which his two daughters suffered from dyspepsia, colicky pains, and headaches, which disappeared when they left the house for the summer, and re-appeared on their return. He found that the wall-paper in the nursery was very arsenical, although, having previously suffered from this same cause, he had made special effort to obtain paper free from arsenic, and had been assured by the dealer that a chemist had analyzed it and pronounced it free from arsenic. During the discussion which followed, many cases of sickness were reported as having been caused by arsenic in wall-paper. Professor Hill of Harvard university said that he was the examiner for two of the most prominent paper-houses in the state of Massachusetts. During the period from 1879 to 1883 the percentage of arsenical papers was from fifty-four to sixty-five of all papers examined. In 1884 it had fallen to forty-seven per cent, and in 1886 to thirty-three per cent. Only thirteen per cent contained any thing more than a trace of arsenic. In reference to the law which had failed of passage in the legislature, limiting the amount of arsenic to one-fifth of a grain in the square yard, he thought our knowledge of the limit which it is safe to establish was too indefinite. A law to prevent the sale of 'rough on rats' would save more lives than a law to prohibit the sale of wall-papers containing a trace of arsenic. Professor Wood of Harvard university thought the chief danger was from the dust which is constantly being given off from the paper, and which is contained in the air of the room, by which it comes in contact with the

eyes, nose, and throat. Professor Hill of Cambridge considered that the idea of establishing a limit to the degree to which arsenic may exist in wall-papers was faulty, from the fact that there is no reason for the use of arsenic at all in the manufacture of wall-papers. Colors can now be obtained which are free from arsenic as an impurity, and those colors should certainly be employed in all papers. Dr. Chadwick offered the following resolution, which was unanimously adopted: "*Resolved*, that it is the opinion of this meeting that the clinical evidence already adduced in this and other countries establishes beyond doubt the fact that arsenical wall-papers will, in many instances, produce symptoms of poisoning by arsenic in persons occupying the rooms whose walls are covered by such papers."

## *THE MEDICO-LEGAL ASPECTS OF HYPNOTISM.*

A. BINET, one of the leading French authorities on hypnotism, has written an appreciative but critical notice of the work of Campili that gives an excellent view of the French and Italian standpoints regarding this subject that is assuming so much importance there. Dr. Campili has had the advantage of numerous memoirs in France and elsewhere. M. Legeois has shown the possibility of making the hypnotic suggestion serve a criminal purpose, but has not discussed the subject. MM. Binet and Féré set themselves to determine the conditions under which the reality of the hypnotic suggestion may be admitted by a tribunal — the judicial proof, in other words. Dr. Campili presents the problem from the point of view of the two schools of criminologists in Italy, the classical or spiritualistic school, and the anthropological school, which differ not only in their theoretical conceptions but also in their practical conclusions upon the application of punishment. Upon the question of hypnotism, however, the two schools admit the same conclusion. Dr. Campili examines what the civil and penal responsibility of the hypnotized subject is when criminal acts have been committed or obligations have been assumed under the influence of a hypnotic suggestion. According to the classical legal school, the hypnotized subject is not responsible, since he has not committed a voluntary and conscious offence: there can be no punishment where there has been no fault. The anthropological school, which does not assume this subjective point of view, but considers that the judicial institutions have the simple function of social preservation and defence, arrives at the same conclusion, but by a different way. In a very detailed discussion the author arrives at the conclusion that the needs of social defence only demand the repression of criminal acts when these are the expression of the personality of the agent, and since in the hypnotic subject the individual reaction is abolished, the acts that he does under the influence of a hypnotic suggestion are simply those of an automaton. These conclusions are at least debatable, says Binet, and rest on premises that contain an error of fact. The belief is too common to-day that it is possible to characterize the psychical state of hypnotism in a single word and say it is a condition of automatism. In a vast number of cases the subject preserves his intellectual and moral identity: when he receives a suggestion to act, he may resist if the act is in contradiction with his character, and he may examine the order and even absolutely refuse to obey. Campili seems to have seen this difficulty, for he recalls that in an ingenious article M. Bouillier has admitted a moral responsibility in dreams, but he meets this objection with an argument of little weight, that the hypnotized subject does not preserve his personality in the same way that a sleeping person does.

*Il grande ipnotismo e la suggestione ipnotica, nei rapporti col diritto penale et civile.* By G. CAMPILI. *Revue philosophique*, October, 1886.

Binet holds, on the contrary, that the closest connection exists between the effects produced by suggestion and the state of dreaming. The hypnotic suggestion is nothing else than a dream produced and directed by assistants. In fact, the somnambulist is not an automaton, he is an *individual*, and, from the purely theoretical and moral point of view, he may be held partially responsible for his acts These conclusions are in direct accord with those of M. Bouillier.

But what is the practical point of view? Has or has not society the right to defend itself against the crimes of hypnotism? Will it suffice for the assassin to show that he was under the influence of a suggestion for the judges to grant him his liberty and allow him to begin his work again? Clearly a uniform toleration is out of the question. Until recently hypnotism figured only accidentally in judicial proceedings, but now all this is changed, and hypnotic suggestion may readily enter into criminal proceedings. This is exactly what has happened in Turin, where, says Lombroso (*Revue scientifique*, June 19, 1886), there is a veritable epidemic of hypnotism. Society must protect itself against such a danger. Garfolo, in his remarkable work on *criminologie*, argues that we must apply to the criminal who has committed a punishable act in a state of hallucination or of somnambulism the same treatment that we give to those who have committed a crime in an epileptic or hysteric attack or from

the effect of impulsive mania; that is, seclusion in a criminal asylum for an indefinite period until a complete cure is established, or until the patient passes into some other condition that renders a repetition of the act an absolute improbability. Campili thinks that it would be difficult to apply the same punishment to an hypnotic criminal, since he did not commit the crime of his own accord but under the influence of a third person, who is the true culprit: the hypnotic subject is simply an instrument of crime in the hands of the hypnotizer the same as a revolver or a knife, and it is he who ought to bear the responsibility of the act. This is a subtle distinction. The hypnotic subject, like the epileptic, is a dangerous person, a veritable *malade*, since he allows a very simple manoeuvre to make him commit a crime. It is absolutely necessary to put him beyond the possibility of doing harm. Moreover, it is probable that the dread of punishment exercises a restraining influence over the minds of those who submit voluntarily to be hypnotized: in fact, Binet holds, many persons who are slightly hypnotizable may resist hypnotization successfully, and ought to be responsible for consenting to submit themselves to the experiment. There is the strongest reason for this conclusion if the subject knows in advance, before going to sleep, that a criminal suggestion will be given to him. There is one curious hypothesis that Campili has not anticipated, and one which well-known facts render extremely probable, and that is that we may find some day in some band of thieves or assassins a hypnotic subject who of his own accord yields himself to criminal suggestions: the usefulness of hypnotic suggestion under such circumstances is easily understood, for those who are under the control of a suggestion have more audacity, more courage, and even more intelligence, than when they act of their own accord. There are patients who, dreading to be put to sleep by some one that they dislike, offer to the hypnotic suggestion of one of their friends a power of resistance that they do not have naturally. Others, wishing to accomplish some act, and fearing that their courage will fail at the last moment, suggest themselves the act that they wish to do. In these circumstances the subject should be punished as the principal and the hypnotizer only as an accomplice.

The Paris correspondent of the *Medical record* writes last December that an epidemic of hypnotism prevails there, and he paints the prevailing distemper in exceedingly dark colors. Every steamer brings some new book on hypnotism or mental suggestion, and the amount of literature that has accumulated within the past year is enormous. Public exhibitions of hypnotism have been interdicted in Germany, Italy, and Austria. This is but one side of the shield, however, and brilliant therapeutical results have been reported by the skilled coterie of French physicians that has advanced our knowledge of hypnotism so much within the past few years. Yet on the whole, perhaps, it is a matter for congratulation that the more stolid American mind has been little affected by hypnotism up to this time, not even to the extent of furnishing sufficient subjects for the Society for psychical research. It may be that the 'mind-cure' is our cross, and at any rate the connection between this and hypnotism offers a promising field to the investigator.

WILLIAM NOYES.

## *PALEOLITHIC MAN IN LONDON AND ITS NEIGHBORHOOD.*

EVER since Dr. John Evans, in the year 1860 (*Archeologia*, xxxviii. 301), showed that the object was a genuine paleolithic implement of the Chellean type, which, under the disguise of 'a British weapon found with elephant's tooth near Gray's Inn Lane,' had been lying for years unnoticed in the British museum, a peculiar interest for prehistoric archeologists has attached to the quaternary gravels of the valley of the Thames. This noteworthy implement seems to have been discovered some time at the close of the seventeenth century, and an account of it, illustrated by a rude engraving, had been printed so early as 1715. Consequently the city of London may lay claim to be the site of the first recorded discovery of the earliest implements of mankind. Similar discoveries have continued to be made in different parts of the valley of the Thames, especially in that portion of it lying within the county of Middlesex. Mr. Worthington G. Smith, in particular, published in the *Journal of the anthropological institute* accounts of finding paleolithic implements in the little tributary valleys of the Lea and the Brent. But in 1883, after five years of patient research, he made known the interesting discovery (published in the same journal, xiii. 357) of a 'paleolithic floor at North-east London.' He showed that a stratum of worked flints of the paleolithic age lay spread for many miles a few feet beneath the present surface of the ground. The majority of the implements contained in it were found at the height of about seventy-five feet above the present level of the Thames. "As a rule," he says, "every implement and flake is as

*Paleolithic man in north-west Middlesex. The evidence of his existence and the physical conditions under which he lived at Ealing, and its neighborhood, etc.* By JOHN ALLEN BROWN. London, Macmillan.

sharp as it was on the day it was made." The best section of this 'floor' was at Stoke Newington Common, where there was found, about four feet below the surface, an immense accumulation of paleolithic implements, of both the pointed and oval types, numerous scrapers and hammer-stones, with cores and flakes innumerable.

Mr. J. A. Brown has been prosecuting similar researches in the north-western part of London, and has discovered in the high-level gravels at Acton 'a paleolithic workshop site,' in which some five hundred or more of such objects have been found at a depth of six feet below the surface. "The whole of the specimens," he says, "are as sharp as when they were flaked off from the cores, and it is clear that they have never been removed from the spot, where they were left by the paleolithic people, who made them, when they retreated before the advancing waters" (p. 57). The present volume, embodying the substance of several papers read before various scientific bodies, contains an interesting narrative of his own investigations, and those of other explorers, and is profusely illustrated by engravings of specimens of all the different objects which have been found by Mr. Worthington Smith as well as by himself. But Mr. Brown has also availed himself of the opportunity of compiling from many sources an extended study of the condition of certain savage races, for the purpose of illustrating the probable mode of life, conditions, and culture of the river-drift men. With one of his conclusions, however, I feel constrained to differ. From what seems to be very insufficient evidence he has drawn the inference that the paleolithic man 'had invented or used the bow and arrow,' His reasons for this opinion, so much at variance with that held by most prehistoric archeologists, are that he has found a few small triangular flakes which he styles "the earliest form of arrow-head," and thinks they "could hardly have been used in any other way" (p. 72); and also other flakes having on one side "worked hollows, which are generally regarded as shaft-smoothers" (p. 116).

Now Mr. O. A. Shrubsole, in an article on 'Certain unfamiliar forms of paleolithic implements' (*Journal of the anthropological institute*, xiv. 196), has argued that man in a primitive state, having only natural forms of growth to avail himself of, such as wood, bone, or horn, would of necessity fashion tools for scraping-purposes, with curved outlines; and to me it seems unreasonable to restrict similar implements to the sole purpose of 'shaft-smoothers' for arrows. Mr. Worthington Smith has reached the conclusion that the makers of the implements, which he has discovered in such abundance, "depended for food upon roots and wild plants, and the bodies of small animals slain by stones thrown from the hand;" and he does not believe that the objects found by him were intended for weapons, but for tools. Mr. Brown's rejected hypothesis, that the small triangular flakes, which he has figured, if indeed they are implements at all, were used as 'points of small harpoons for killing fish' (p. 117), seems much more probable, than that the paleolithic man, as I have attempted to show elsewhere (*Proceedings of the Boston society of natural history*, xxiii. 269), should have invented such an ingenious and complicated instrument as the bow and arrow. HENRY W. HAYNES.

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## *RIDGWAY'S NOMENCLATURE OF COLORS AND COMPENDIUM.*

EVERY naturalist has doubtless at times seriously felt the need of some means of identifying the various shades of color he is called upon to designate in describing animals or plants, or interpret in the descriptions given by other authors. No standard work, duly illustrated, having this end in view, has for many years been available. This want Mr. Ridgway has now attempted to supply. His 'nomenclature of colors' comprizes fifty-eight pages of text and ten colored plates. A brief discussion of principles of color is followed by a chapter on the selection of pigments and their combination to produce required effects, and a comparative or polyglot vocabulary of colors, in which is given the equivalent terms in seven languages of more than three hundred designated shades of color. About one hundred and seventy of these shades are defined and illustrated by the plates, and their composition indicated by explanatory text. This forms part i. of the little manual under notice. Part ii. consists of an 'ornithologists' compendium,' devoted mainly to an extended glossary of technical terms used in descriptive ornithology, illustrated by six outline plates, relating to the topography of a bird, the forms of feathers, the patterns of color-markings, and the contour of eggs.

Mr. Ridgway has thus not only attempted to fix and illustrate a standard nomenclature for the "numerous hues, tints, and shades which are currently adopted, and now form part of the language of descriptive natural history," but has brought together a most convenient mass of technical information of great importance to ornithologists, whether specialists or amateurs.

*A nomenclature of colors for naturalists, and compendium of useful knowledge for ornithologists.* By ROBERT RIDGWAY. Boston, Little, Brown & Co. 8°.

SCIENCE.

FRIDAY, MARCH 11, 1887.

## *COMMENT AND CRITICISM.*

ALTHOUGH CONGRESS HAS NOT ORDERED that the weather-bureau shall be transferred from the signal corps of the army to some civil department, the steps that were taken towards the transfer give strong assurance that it will be made next year, when it can be undertaken more deliberately. The action was briefly as follows: the house bill No. 5190, to create a department of agriculture and labor, received several amendments in the senate, among which the sixth had for its object the transfer of the weather-bureau from the signal office of the army to the new department on the 1st of next July. Although several senators voted on Feb. 23 against this amendment, because they thought the action was too precipitate, it had a majority of thirty-seven to fifteen, with twenty-four absent. It provided that the second lieutenants and the subordinate members of the corps should be transferred to the new department, without changing their work or their pay; that the rank of commissioned officers of the signal corps should not be affected by the transfer; and that the chief signal officer should remain in charge of the bureau after the transfer until a director should be appointed for it. The bill then returned to the house, where, according to the reports we have received, it would have certainly been passed as amended, had not an unforeseen obstacle arisen. The President, it seems, does not desire an additional member in his cabinet: the bill was therefore referred back to the committee on agriculture by his friends in the house, and at this late date in the crowded session it could not again be reached, not being 'privileged business.' So the matter is dropped for the present.

This postponement is, on the whole, not to be regretted. It is quite clear that the failure to make the change was not due at all to a belief that it ought not to be made. Senator Edmunds offered the only considerable objection to the transfer during the debate on the amendment. It was clear to him, "that the only way to have an effective organization is to have it under military control, so that a man cannot resign because he gets miffed about something, but he must do his duty." This mistaken impression found few if any supporters. It seemed to be generally understood that the loss of individuality and complete submission to authority, which constitute the essence of the military spirit, are out of place in a service that wisely makes open declaration of its need of intelligent personal action by calling on college graduates to enlist in it. Senator Dawes thought every one agreed that the service "ought to be transferred to the civil department of the government," but believed that the transfer ought to be made more deliberately than was contemplated in the amendment. Senator Hale expressed the same views, and these two joined Edmunds and others in voting against the bill. But their favorable votes may be expected next winter, when perhaps less political and more appropriate surroundings may be chosen for the weather-bureau than it would have found in the proposed new department.

In the mean time the position of chief signal officer is given to Captain Greely, who is thereby promoted to be a brigadier-general, the senate having confirmed the President's nomination at the last moment. So great an advance in rank is unusual, and may be attributed in part to recognition of arctic heroism, — for surely the preservation of a complete series of records under the most difficult and tragic circumstances was a splendid achievement, — and possibly in part to the feeling that the office should be given to some one already in the service, rather than to some colonel who stood, indeed, nearer in the line of promotion, but who had had no experience in the weather-bureau. But the failure of the deficiency bill makes the position of chief signal officer an arduous one for the next year, for it is a thankless duty that involves reduction in some of the essentials of the service. It is to be regretted that the new chief was not given at least the best opportunity of showing his powers. The remedy for unsatisfactory weather-predictions is not likely to be found while the service is thus embarrassed.

Small-pox is said to have appeared recently at Holyoke, Mass., among the rag-sorters of the paper-mills, presumably contracted from handling infected rags. There are two points of interest in connection with these cases, on which we should like information: first, were the suspected rags domestic, or foreign? and, second, were the rag-sorters vaccinated, and, if so, when was the operation last performed? The necessity for disinfecting foreign rags has been so much discussed of late years, that every instance of this kind should be thoroughly investigated, and the results reported in detail.

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The newest monograph of the American economic association is, like its predecessor, a study of co-operation. But the field of observation is shifted from Minnesota to New England. The author, Mr. Edward W. Bemis, keeps himself in the background throughout, only occasionally in the tone of his treatment giving indications that he is a believer in co-operation as a remedy for many of the existing and much-commented-on labor-troubles. The monograph is contained in one hundred and thirty-six pages, and gives a succinct account of the various co-operative and profit-sharing enterprises undertaken in New England, from the time of the hapless Brook Farm (1842–47) to the introduction of profit-sharing into a Boston newspaper establishment at the beginning of the present year. Distributive and productive co-operation are treated separately; for they are very different things, the former being the simpler, more easily managed, and requiring a far smaller amount of capital than the other. The conditions of productive co-operation are more complicated and involved than those of co-operative distribution, and therefore the latter comes first in the order of time.

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In New England the development of the co-operative movement seems to have been continuous, for members of the Brook Farm community were prominent in the co-operative enterprises of the Sovereigns of industry and the Knights of labor; and the various protective unions, and so forth, seem to have grown one out of the other. The Sovereigns of industry, organized in 1874, assert that they were the first to introduce the Rochdale plan into this country, but members of the New England protective union claim to have established co-operative stores on the Rochdale plan in Boston as early as 1864. The peculiarity of the Rochdale plan is, as is well understood, that goods shall be sold at the retail market-price, and any profits that remain, after an allowance has been made for a reserve fund and interest on capital, are apportioned to the customers on the basis of their trade for the period since the preceding distribution; it is permitted to stockholders, however, to receive a larger dividend than is paid to outsiders.

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As Mr. Bemis himself says, the record of the early years of the co-operative movement contains more failures than permanent successes. A comparison of the causes of failure, as adduced by the author, shows a curious agreement, even in the case of enterprises undertaken under conditions quite diverse. The New England protective union, for example, went along from 1847 until 1852, when it had as many as four hundred and three subdivisions, of which one hundred and sixty-five reported total sales the previous year of $1,696,825.46. No attempt had been made to secure large profits; goods were sold at as near the cost-price as was deemed consistent with safety; and the members were satisfied with six-per-cent dividends on the stock. But there was frequently a simultaneous increase, both in the price of goods and in the amount of dividends to the comparatively small number of stockholders. "Many stores thus ceased to be co-operative, and the stock passed into the hands of a few of the more enterprising or well-to-do."

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It is the same story all the way through. "The underlying causes of all co-operative failures are lack of intelligence and of the spirit of co-operation." After a time there is a disagreement; the management is declared to be arbitrary; the storekeeper is paid too much; it is asserted that better bargains can be made outside. This creates lack of confidence, and to restore it there is a departure from the cash principle, or an increased dividend is declared. The result is disastrous. Most of the above sentences are culled from Mr. Bemis's history of the various concerns, and not a few of them are in substance the words of such believers in co-operation as Holyoake, George E. McNeill, and others. They involve the admission of all that the friendly critics of co-operation claim; that is, that it is an ideal scheme, suited to a perfectly homogeneous community, the members of which are willing to make extensive temporary sacrifices in order to its ultimate success. For this

reason it cannot become a universal economic system. The same human nature that interferes with so many other beneficent schemes, interferes with this. "Co-operative concerns fail because of a failure to co-operate," is the universal verdict.

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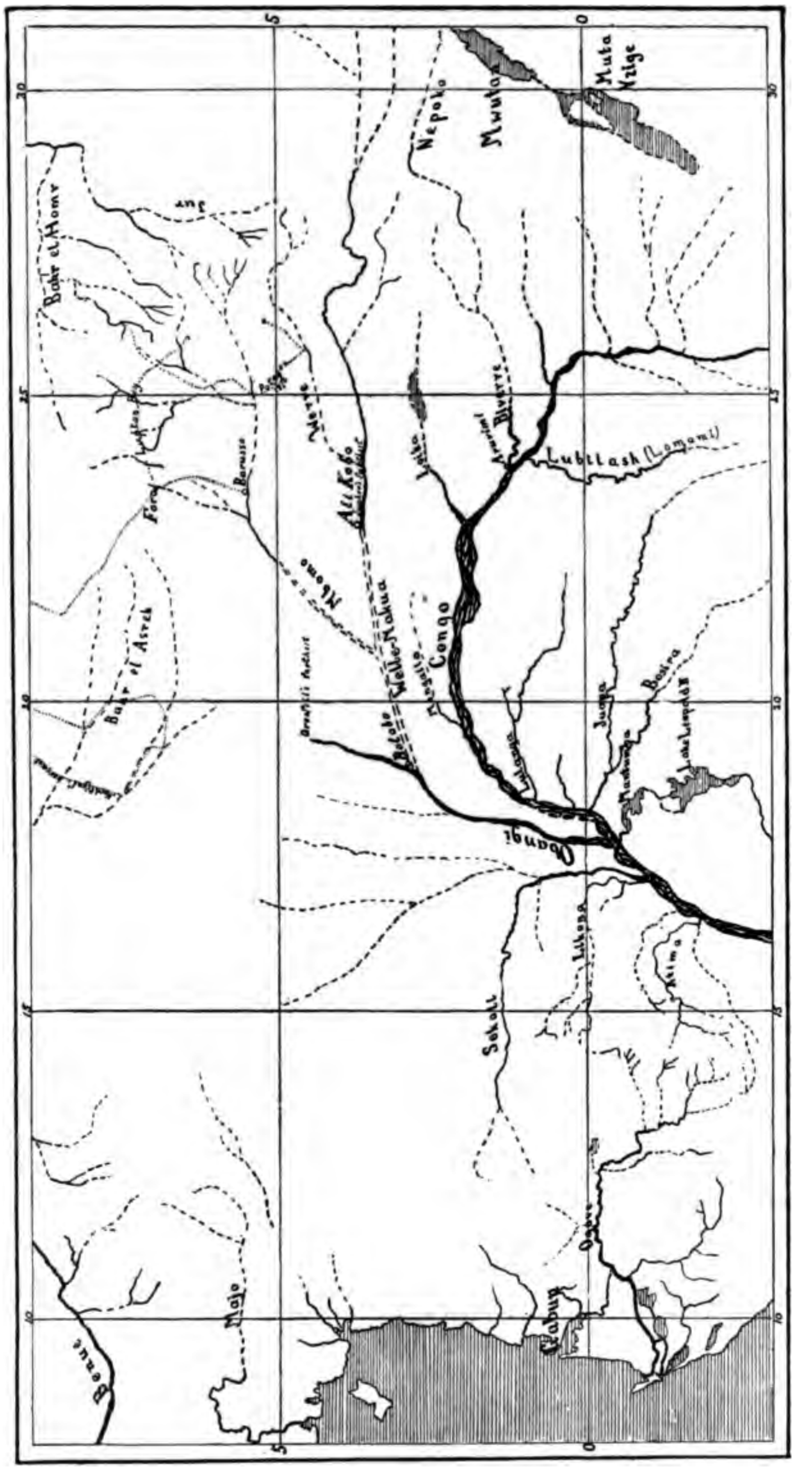
It is but fair to point out that the data gathered from the latter part of the period of which Mr. Bemis writes, are more favorable to co-operation. Increased experience may have something to do with this. From the tables compiled by the author, it appears that productive co-operation in twenty companies in New England shows a business of $1,000,000 a year; co-operative stores have a trade of over $1,750,000; co-operative creameries do a business probably of $1,000,000; and about $3,250,000 are invested in co-operative banks. So that, apart from co-operative insurance companies, the annual business of the co-operative companies of New England amounts to about seven millions of dollars. In Massachusetts the conditions seem to be specially favorable to co-operative companies, as the state has a general law for their incorporation. The capital stock of such a company is limited to $100,000, and must be more than $1,000. No one person can hold more than $1,000 worth of stock, or have more than one vote. It is further provided that there shall be an annual distribution of profits among the workmen, purchasers, and stockholders; but ten per cent of the net profits must first be set aside for a contingent or sinking fund, until a sum equal to thirty per cent of the capital stock shall have been accumulated. The word 'co-operative' must form part of the corporate name, and shares to an amount not exceeding twenty dollars are exempt from attachment and execution. The credit of the company and security of the stockholders are further increased by a full report made annually to the secretary of state. The last section of the monograph is devoted to profit-sharing, and brings forward some interesting instances in which it has been put in operation. The best known, perhaps, is that of the Peace Dale manufacturing company, where profit-sharing was begun eight years ago. An average dividend of four per cent on the wages was paid to the workmen for four years, but since 1883 no dividend has been declared. From none of the cases of profit-sharing adduced by Mr. Bemis can we deduct any arguments which meet the objections of Mr. Aldrich, on which we commented last week.

## THE EXPLORATION OF THE WELLE.

SCHWEINFURTH has recently sent a letter to the editor of *Le mouvement géographique*, from which we take the following abstract: The Welle-Makua has been crossed by Junker at six different points. At Ali Kobo, in the country of the Basange, his farthest point west, the river attains such dimensions that he could not estimate its size, particularly as it is blocked up by islands, which are not only densely populated and highly cultivated, but afford ample room for herds of elephants which abound there. Junker could not stay here longer than four days. Only a comparatively short distance from the Kongo, he was compelled to return, as Lupton Bey, the governor of the Egyptian province Bahr-el-Gazal, sent him word of the rapid spreading of the mahdi's power. Eight days' journey beyond the extreme point reached by Junker, the Mbomo empties itself into the Welle. The Mbomo runs east and west, and has many tributaries, which come from the watershed between the Kongo, the Shari, and the Nile. In February, 1883, Junker reached Abi Kobo. Junker's 'Nepoko' is probably the upper course of the Biverre. He heard another river mentioned, the Nava, which, however, he did not see. Schweinfurth is of the opinion that it may be the upper course of the Biverre, while the Nepoko may be that of the Mburu. The quantity of water in the latter is, however, so small that its source must be looked for farther west.

Wauters's hypothesis of the identity of the Welle and Obangi becomes very probable by Junker's new discoveries, as will be seen by the accompanying sketch-map. Wauters supposes that Grenfell, who explored the latter river, passed by the mouth of the Welle without seeing it. The remarkable form of the right bank of the Obangi, the appearance of the first hills at the place of the supposed confluence, the dotted lines by which Grenfell indicates the left bank at this point, and the suddenly increasing shallowness of the river, all support Wauters's hypothesis. This new information is of great importance for the progress of Stanley's expedition for the relief of Emin Pasha. He may either ascend the Obangi and Welle, the Biverre-Nepoko, or start from Stanley Falls. It is doubtful whether there are any rapids in the Welle that might obstruct his passage. As Grenfell passed the rapids of the Obangi in latitude 4° 30′ north without any difficulty, and those of the Kongo at Rubungu do not prevent the passage of steamers, it is possible that no serious difficulties of navigation exist.

We may be allowed to call to mind at this place the sources of our former knowledge of this district. After Schweinfurth's discovery of the




SKETCH-MAP SHOWING RECENT EXPLORATIONS ON THE WELLE.

Welle, Nachtigal was the first to give some new information. In 1875 he published a map from his surveys and from information obtained in Dar For and Wadai. Junker explored, in 1876 and 1877, the western tributaries of the Bahr-el-Abiad. In the same years a Greek physician, Panagiotes Potagos, travelled over a great part of the district. As, however, he made no astronomical observations, and his itinerary is very primitive, the results of his journey are not reliable. This is still more the case with Bohndorff's journeys. This man, a goldsmith, who had been in the service of General Gordon, travelled in the region of the head waters of the Welle. Later on, when Junker started on his second journey, he took Bohndorff for his servant, and in January, 1880, they left Khartum. The first summer was spent in the Niam-Niam country, and since that time Junker has travelled in Mombuttu and in the district of the Welle and the other rivers running west. Lupton Bey and his agents made many important journeys, the expedition of Rafai Aga being of particular interest. He is said to have reached the lake on the Lokoi. The north-western tributaries of the Bungu, as shown on the sketch-map, are from Flegel's reports, who learned about them on his journey in Adamaua. The central part between the regions traversed by Flegel, Nachtigal, and Junker, is still totally unknown.

## THE HEALTH OF NEW YORK DURING JANUARY.

THE population of New York City at the beginning of 1887 may be approximately stated to have been 1,461,466. The deaths during the month of January from all causes were 3,507, which is but 5 more than during the preceding month, although the population was greater by more than 3,000. Of this number, 140 died on the 5th, the greatest mortality of the month (see page 228). Diarrhoeal diseases caused 48 deaths, a reduction of 17 as compared with December, and the lowest mortality from this cause since March, 1886. The deaths of children under five years of age amounted to 1,523, differing but little from the preceding month. Consumption caused 524, diphtheria 204, and scarlet-fever but 46 deaths. The mortality from the last-named disease was double that of December. In November there were recorded 166 deaths as due to measles. In December this increased to 271, and in January the mortality rose to 294, exceeding by no inconsiderable figure the combined deaths from diphtheria and scarlet-fever, emphasizing, what we have already directed attention to, that measles is not a trivial disease, but one in regard to which all precautions relating to isolation and disinfection should be promptly and thoroughly taken and maintained.

The maximum temperature of the month, 62° F., was reached at 4 P.M. on the 23d. This was nearly ten degrees above the average for the past ten years. The lowest point reached by the mercury was 4° F., at 12 P.M. on the 18th, and again on the 19th at 2 A.M. The average for the decade is 3.1° F., although during the same month of 1879 it fell to −4° F., and in 1882 to −6° F. The rainfall for January was 4.42 inches, included in which are 6.625 inches of snow. The average rainfall for this month for the ten years commencing 1878 is 3.82 inches, so that more than the average fell during January. The largest amount of snow which fell during this period in the same month was 17.5 inches, in the year 1882. Since then, in but one year, 1885, has less snow fallen than during January of 1887: the average has been nearly 10 inches. There were four snow-storms during the month. In that which occurred on the 5th and 6th, 2 inches fell; that of the 9th and 10th resulted in a fall of 4 inches; while the others were insignificant.

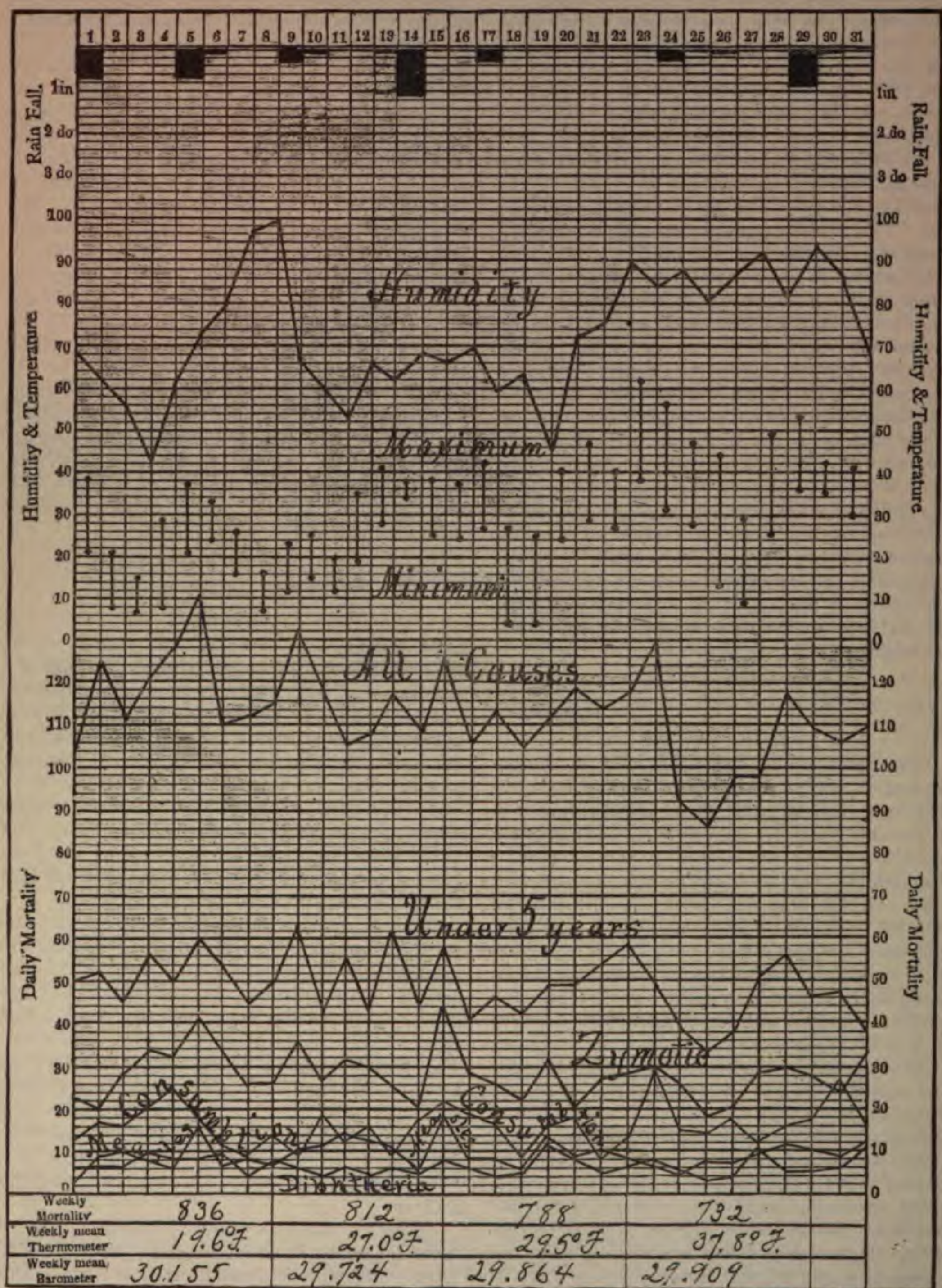
## GEOGRAPHICAL NOTES.

### Africa.

Dr. Hans Schinz gives the following report of the present state of Lake Ngami. The lake has not dried up, but is gradually decreasing in size. The Okavango, or Ombuenge, forms, north-west of the lake, an extensive swamp, and during the dry season the lake receives only a small quantity of water from it. During the rainy season, however, the small brooks swell up and form a large stream, which empties itself into the lake. The Tamulakan, which branches off from the Ombuenge in latitude 18° 40′ S., empties itself into the Botelet, not into the Zambezi.

Gottl. Ad. Krause has succeeded in entering the territory south of Timbuktu. Since Barth's expedition in 1853, no white man has visited this district. On the 7th of July, Krause left the large city of Salaga on the Volta, and later on reached Mosi, whence he started on Oct. 26 for Timbuktu. The district through which he has travelled has been known only through information obtained by Barth. Our knowledge of the district between the fabulous Kong Mountains and the most northern part of the Niger is still extremely imperfect, being founded only on information obtained from natives.

Under the auspices of the secretary of state of France, Camille Douls is going to explore the Wad Draa, which empties itself near Cape Noon. This periodical river runs at some distance along the


Rain Fall.
Humidity & Temperature.
Daily Mortality
Humidity
Maximum
Minimum
All Causes
Under 5 years
Zymotic
Consumption
Measles
Diphtheria
Weekly Mortality 836 812 788 732
Weekly mean Thermometer 19.6°F. 27.0°F. 29.5°F. 37.8°F.
Weekly mean Barometer 30.155 29.724 29.864 29.909

south side of the Anti-Atlas, and drains its southern slope. It was crossed by Leopold Panet in 1850, about fifty miles above its mouth; by Si Bu-Moghdad in 1861, about twenty-five miles lower. Rabbi Mordochai followed one of its tributaries, and crossed it at the same place where Lenz did in 1880, about 120 miles above its mouth. Panet and Bu-Moghdad travelled very hurriedly, with a large caravan coming from St. Louis, on the Senegal, and had no chance for making many observations. In 1828 Caillié ascended its upper part on his return from Timbuktu. Douls intends first to visit Wad Sus, which is situated between the Anti-Atlas and the High Atlas. Rohlfs ascended the valley in 1862, when he explored the upper part of the Wad Draa and the Oasis Tafilet.

### *America.*

Letters from Europe give some more particular information of the object of Dr. K. von den Steinen's expedition to Brazil. Three years ago he and Dr. O. Clauss surveyed the whole length of the Xingu. Von den Steinen intends to complete this work by exploring its sources. He will start again from Cuyaba. As on his former expedition geographical researches formed the main object of the journey, he could not make a long stay among the interesting tribes of the upper Xingu. Nevertheless he obtained ethnological information of great importance. On the present expedition he proposes to live some time with the Indians of that district, who have never been in contact with whites, and therefore are of particular interest for ethnologists. Dr. P. Ehrenreich, who has studied the tribes of Rio Doce, and made valuable anthropological observations during his journey, and the painter Wilhelm von den Steinen, will be his companions. This expedition, which consists exclusively of scientists who are thoroughly acquainted with the field of their researches, will yield valuable results.

Mr. H. N. Ridley, assistant to the British museum, is going to visit Fernando Noronha, the lonely island off the Brazilian coast. The Brazilian government has granted him permission to make botanical and zoölogical collections on the island, though generally visits of strangers are prohibited on account of a colony of convicts being established there.

### *Polar regions.*

Gilder has returned from his journey to Hudson Bay, and given up for the present his plan to reach the north pole by this route. We pointed out last week that the difficulties he would encounter were almost insuperable, and are glad to learn that he reached the same conclusion. Gilder arrived at Selkirk, near Winnipeg, March 2. According to his own account, after leaving Winnipeg last fall, he had a very unpleasant voyage to York Factory, occupying two months. He was unable to get a boat all the way, and had to proceed in a canoe, getting Indians to bring his supplies along. He reached Fort Churchill too late to catch a Hudson Bay boat for Nottingham Island, and, as he would have had to stay several months about Fort Churchill without occupation, he decided to return to New York to transact some business, after which he will leave in time to catch the next Hudson Bay boat, several months hence, or else take a whaling-vessel bound for the northern seas next summer. He left his companion, Griffith, at Fort Churchill, with instructions to take the stores and proceed to Nottingham Island by the first Hudson Bay boat. Gilder promised to join him there. It is to be hoped that he will give up the Hudson Bay route for good, and take a Scotch whaler going to Smith Sound instead. The route from Fort Churchill to Lancaster Sound by boat and sledge is impracticable, and ought not to be attempted by an explorer who wishes to visit the extreme north.

### *General.*

Charles A. Schott has continued his study of the observations on terrestrial magnetism in America. In his former papers, which were published in the annual reports of the coast and geodetic survey for the years 1880–82, he treated the declination. The present paper — Appendix 6 to the report for 1885 — contains a large collection of observations on the magnetic dip and intensity. The collection of data is very complete and clearly arranged, so that it is easy to find the elements of any desired place. It will be of permanent value to the student of terrestrial physics. Schott discusses this large collection of data in order to ascertain the secular change of the magnetic dip and intensity, and uses the results of his researches, with due reserve, for the construction of charts of the United States showing the lines of equal magnetic dip and intensity. His scrutiny of the observations leads him to the conclusion that it is impossible at the present time to give a detailed map of this kind. The observations of most places are made at too long and irregular intervals, and are not sufficiently reliable. Therefore he gives only a general map of the course of these lines. The belts of stationary dip and intensity, which are indicated in the maps, showing the boundary between increasing and decreasing dip and intensity, are of special interest. The belt of stationary dip runs through the Strait of Florida, crosses the Mississippi just above its delta, and then turns again south, passes through central Texas, through

northern Mexico, crosses the Gulf of California, follows the coast of southern California, and passes out to sea off San Francisco. South of this belt the dip is increasing; north of it, it is decreasing. The curve of the secular change of the magnetic dip, though generally decreasing, had a secondary maximum about 1860. This subordinate extreme has been passed north of the belt, but has not yet been reached south of it. The magnetic intensity is also decreasing, and reached a subordinate maximum in 1870. Since then it is again decreasing. On the map showing the lines of equal horizontal force, Schott has marked the approximate situation of the region of stationary horizontal intensity. It runs from north-west Florida through Georgia, Tennessee, Missouri, Nebraska, Wyoming, and western Montana. South of this belt the horizontal force is decreasing; north it is increasing.

G. Hellmann has discussed the statistical data on damage done by lightning in Sleswick-Holstein, Baden, and Hesse, which are contained in the reports of the insurance companies. He finds the danger from lightning, though generally increasing, to be decreasing in certain districts. The danger becomes less the more closely the houses are clustered. The petrographical character of the ground is of great influence. If the danger from lightning upon calcareous soil be represented by 1, 2 will represent the danger upon marly, 9 upon sandy, and 22 upon clayey soil. No explanation can be offered for the fact that, among trees, oaks are struck most frequently. If the danger for beeches be 1, that for pine is 15, for oaks 54.

## *NOTES AND NEWS.*

IN a report by Passed-Assistant Surgeon T. H. Streets, U.S.N., of the U. S. coast survey steamer C. P. Patterson, surveying in the waters of Alaska, after referring to the vast forests of spruce, cedar, and hemlock which clothe the shores and mountains and islands of south-eastern Alaska with everlasting verdure, and alluding to the herring, cod, and halibut which inhabit the deep waters, the immensity of the schools of salmon is illustrated by the following account of what he saw at Naha: "To illustrate how immense are the schools of salmon, I will relate what I saw at Naha, where they crowded into a stream of fresh water in such numbers as to materially impede the progress of our canoe. Bruised, lacerated, and killed in attempting to surmount the falls that obstructed their course, suffocated in the jam below, where the water was awork with them, with backs and dorsal fins protruding, their dead bodies lay two and three deep along the shores of the stream, and for fifteen to twenty yards from the water's edge, where they had been left by the receding water. The mouth of the stream was obstructed by a wire trap held to the banks by a wire fence. The trap, at the time of our visit, was raised to allow the fish to enter the stream. The wire fence was broken down by the weight of the mass of dead fish drifting against it, and many must have been carried to sea by the tides and currents. The air was offensive with the odor of the decaying carcasses. Flocks of ravens and gulls fed upon the dead, and the bears fattened upon the living; yet sufficient numbers overcome the high falls yearly to provide for the annual return of the swarms. A large fishery is located there, which also does its part to reduce their numbers. It is a blind instinct which leads migratory fishes to return to the streams where they were hatched; and Nature is prodigal with her forces in carrying out her plans."

— The signal service will be seriously crippled by the failure of the deficiency appropriation bill. The chief signal officer says, "It is now impossible to remove a man, even to discharge or recruit him, or to replace those who are dead or dangerously ill." The term of service of a number of men has expired, but they must remain in the corps from lack of money to send them to their homes. The telegraphic reports of cold waves, storms, warnings, etc., must be discontinued at a number of important points, as the funds on hand for that purpose are nearly exhausted.

— The new German *Centralblatt*, devoted to bacteriology and parasitology, continues to furnish its readers weekly with records of recent researches on these subjects. We understand that Dr. G. Sternberg will confine himself to reporting American original work on micro-organisms, and that Prof. R. Ramsay Wright, Toronto, has undertaken to furnish a similar account of papers published in America on animal parasites and on epidemics occasioned by them. Professor Wright will be obliged to authors for extras of such papers, which will be promptly noticed in the *Centralblatt*.

— The annual consumption of cocoa is 80,000,000 pounds, produced principally in the West Indies and South America. France consumes 26,000,000 pounds; Spain, 16,000,000; England, 14,000,000; and the United States, 8,500,000. Since 1860 the consumption of cocoa in the United States has increased sixfold; during the same period, that of coffee and tea has not quite doubled.

## LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The failure of foreign trees on American soil.

ALLOW me to enter a respectful protest against the sweeping judgment of Professor Sargent in condemnation of foreign trees, which you publish approvingly in your issue of March 4. Though there is, no doubt, a great difference between the climate of this continent and that of Europe, and though unquestionably tree-growth is most dependent upon climatic conditions, yet it would be unwarrantable, from its failure in one place or even several places in this country in ornamental plantations, to generalize upon the adaptability of an exotic species for *forestry* use. It seems to be generally overlooked, if not unknown, in this country, that forestry and arboriculture, or tree-planting as practised by the horticulturist or landscape-gardener, are not the same thing, but in their objects, and consequently in their methods and results, are entirely different. While in ornamental planting the individual tree is the object, and its form in its unity and the development of its beauty is the aim of the planter, forestry has to do with an aggregate of trees, which, properly placed and grouped together, grow and develop very differently from the single tree, or even group of trees, on the lawn. The European larch, even in its native country, does not make a desirable lawn-tree in every locality, and, coming originally from the highest mountain elevations, even as a forest-tree, it requires, when grown upon the plain, particular conditions and special management to secure a thrifty growth, and the quality and quantity of timber for which the tree is noted. I have often pitied those in this country who have expected these results without paying attention to the requirements of the tree. As to the Norway spruce, of which Professor Sargent speaks so disparagingly, I have not seen a finer ornamental conifer of its kind on this side of the Atlantic; and though, as is the case with all the conifers, a time arrives when it loses its peculiar beauty, I doubt whether it does so sooner than any others, while, as a forest-tree, it needs only proper conditions and management, I venture to say, in order to attain the size and quality which it shows in its native country. Plant the Norway spruce in dense groves, on a northern or north-western exposure, with the European larch sparingly interspersed, and no planter will live long enough to see these two, thus united, fail in their onward development.

The Scotch-pine, on poor but deep sands on the western prairies, I am sure will make useful timber sooner than the white-pine. * The white-pine was introduced into Germany on large areas about ninety years ago. Growing with great rapidity, and yielding astonishing quantities of wood per acre, the quality of the wood was found to be very inferior until recent years. Experiments have lately shown that the white-pine requires ninety years to make wood of as good quality as the Scotch-pine will produce in seventy years under similar conditions, just as different grains will require different lengths of season in which to mature. These experiments and the many similar ones which could be cited should teach us to be chary of generalizations upon our scanty experiences in forestry in this country.

Of the European willows, so far as osier-growing is concerned, only one, Salix purpurea, seems to have been found adapted to our climate, while several native ones promise success if properly treated.

While I am a most earnest advocate of seeking for the best in that which we have ourselves, and while I advise the planting first of our native trees, with a special study of their requirements, I must deprecate any know-nothing movement against the good things which we may import. Especially let us remember that New England constitutes, territorially and climatically, but a very small part of our country, and that conclusions drawn from experiments there may not be applicable to other portions of it.

B. E. FERNOW.

Washington, March 7.

### Inertia-force.

I had thought that my pamphlet, 'Elementary ideas,' etc., might awaken discussion, and possibly bring about a better understanding among teachers of physics as to the interpretation of certain familiar terms. The discussion has evidently begun. Let us not despair of the better understanding.

Having made, however, one direct attempt to explain to Professor MacGregor my use of the term 'inertia-force,' with the sorry result of disgusting him by the use of "language which is not the current language of dynamics," I shall for the moment adopt a different course, and find a little fault with his way of stating things.

Professor MacGregor accepts fully the doctrine stated by Maxwell in a passage quoted in my first letter, that "all force is of the nature of stress, that stress exists only between two portions of matter," and that "the stress is measured numerically by the force exerted on either of the two portions of matter." I will undertake to show wherein his reasoning seems to me to be inconsistent with this doctrine. He takes my illustration of a railway-train which is being set in motion by a locomotive, and says, "If $F$ is the pull of the locomotive, $R$ the frictional resistance, $M$ the mass of the train, and $a$ its acceleration, we have undoubtedly, by Newton's second law of motion,

$$a = (F - R) \div M."$$

To this every one will agree. Now, with Professor MacGregor's permission, I will put this equation in the form

$$F = R + aM.$$

$F$ is, by his own statement, a force, — the force exerted *by* the locomotive *on* the train. By the doctrine stated by Maxwell, which Professor MacGregor accepts, the force exerted *by* the train *on* the locomotive is also equal to $F$. It is therefore equal to, and may be expressed by, the terms $R + aM$. Now, one part of this force, the part $R$, is accounted for by the resistance of friction transmitted through the train to the coupling of the locomotive. How shall we account for the other part of the whole force exerted by the train on the locomotive, the part $aM$? I call it the *inertia-force*, — the force, or resistance, which the train, *by virtue of its inertia*, exerts on the locomotive which is setting it in motion. I think I can be persuaded to drop the term 'inertia-force,' if a more accurately descriptive one can be adopted; but Professor MacGregor, if I understand him, does not object to the term merely. He denies that the train offers any resistance by virtue of its inertia. But in

denying this he seems to me to reduce the force exerted *by* the train *on* the locomotive to the quantity $R$ alone; and since $R$ is less than $F$, the pull exerted *by* the locomotive *on* the train, he thus abandons the doctrine that "all force is of the nature of stress," and that "the stress is measured numerically by the force exerted on either of the two portions of matter."

The quotation which Professor MacGregor makes from Poisson I shall not attempt to discuss at length; for I am not familiar with his writings, and do not know exactly what meaning he attached to the word *résistance*. If he used this word as I understand Professor MacGregor to use it, to indicate an *opposing force*, and if he was at the same time committed, as I understand Professor MacGregor to be, to the view that one force always implies an equal and opposite force, then I can only say that I think Poisson was wrong in one part or the other of his doctrine.

E. H. HALL.

Cambridge, March 5.

### Comparative taxation.

While I cordially accept all Mr. Henry B. Gardner's statements in regard to the insufficiency of my study of the comparative taxation in Europe and America, I cannot accept his conclusions. He says, in fact, "The inadequate scope of the work has in large measure destroyed the value of the study." To this I cannot agree; and my witness is Mr. Gardner himself. My work has brought out his intelligent criticism, and has turned the attention of himself and of very many other persons to the importance of developing the science of comparative statistics, which is what I have aimed at.

It is very true that I have not attempted to compare the relative taxation of cities, towns, and other subdivisions of states in Europe with those of America; it is very true that some of the cities of this country are excessively taxed as compared to those of Europe: all the more reason for a complete study of the subject. Where are the materials for such an investigation? I have given, to the best of my ability, the relative burden of *national* taxation. I stated that this part of the taxation of countries should be considered separately from that of the towns and cities, for the reason that in Europe a very large part of the national taxation is expended for *destructive* purposes or for the support of privileged classes; while, with the exception of a few cities in this country, the revenues derived from local taxation are paid out for *constructive* purposes both there and here; and on the whole, in spite of the cumbersome nature of the collective work of cities, counties, and towns, the people of this country get about seventy-five cents' worth on a dollar for what they pay in municipal taxes.

Moreover, although Mr. Gardner may not be able to find exact returns of taxation in European countries corresponding to the *per capita* figures which I have submitted, yet I claim to have proved them after as complete examination as is open to a private and unofficial person who does not read German. I hold that the revenue of state forests, mines, and other instrumentalities of subsistence which are often controlled in Europe by governments, constitute as true a tax upon the people as if they had been assessed directly upon their property; and I am of opinion that I have understated the burden of national taxation in Europe rather than overstated it. Suffice it that the figures have attracted attention; and it may be that within one, two, or three years a complete comparison of national as well as state, county, and town taxation may become possible. I should be glad to see Mr. Gardner try his hand, not so much in criticising my work, as in preparing more accurate and more complete tables.

EDWARD ATKINSON.

Boston, March 5.

### On the flight of birds.

The wing is extended upward from the horizontal position by the deltoid and the latissimus dorsi muscles to a line which is perpendicular to the body, and is quickly again depressed to the horizontal position by the pectorales. This constitutes the first stage of the 'stroke.' 'Recover' is initiated by an inward rotation of the humerus, semiflexion of the wing at the elbow (the pinion remaining extended and directed obliquely downward and outward), and is carried well forward to a degree sufficient, when seen in profile, to conceal the head. In this position the primaries are semirotated so as to present the least amount of surface to the air in the direction in which the bird is moving. The impetus excited by the stroke carries the bird upward and forward. In the second stage of 'recover,' the humerus is rotated outward, the arm is quickly raised, the primaries restored to the position seen in the bird at rest, and the wing is a second time in the position for the 'stroke.' In the eagle and the hawk the legs are in the position of the 'stroke' when the wings are similarly placed. During the 'stroke' the legs move backward. This motion continues during the 'recover' of the wing, so that the time of the 'recover' of the wing is also that of the 'recover' of the leg. The action of both wings and feet, since both pairs act together, is what I propose to call 'synadelphic.'

The study of the flight was confined to the eagle, the hawk, the pigeon, and the parrot, in the series of instantaneous photographs taken by Mr. Edward Muybridge, under the auspices of the University of Pennsylvania.

HARRISON ALLEN.

Philadelphia, March 7.

### On the serpentine of Syracuse, N.Y.

An especial interest attaches to this rock for two reasons: 1°, because of the almost total absence of rocks of this class, or indeed of any intrusive rocks, from the undisturbed paleozoic strata of New York; and, 2°, because of the importance which has been recently attributed to it by Dr. T. Sterry Hunt, as affording evidence in favor of his chemical precipitation theory of the origin of serpentine.

The Syracuse serpentine was discovered in 1837, and was described by Vanuxem in his third annual report in 1839 (pp. 260 and 283), and in his final report on the geology of the third district in 1842 (p. 109). It is also mentioned by Beck, in his 'Mineralogy of New York,' as a 'dike or bed' (1842, p. 275). Dr. Hunt published an analysis of this rock in the *American journal of science* for 1858 (xxvi. p. 236), and has laid great stress upon it in his recent essay on the geological history of serpentines.

Through the courtesy of Prof. A. H. Chester of Hamilton college, the writer has been enabled to study a very complete suite of this rock and its associates, which was collected by the late Prof. Oren

Root while he was principal of the Syracuse academy. Mr. J. Forman Wilkinson of Syracuse, who was at this time one of Professor Root's pupils, has contributed several interesting points relating to the occurrence of the serpentine. In a recent letter to the writer, he says, in speaking of the different localities mentioned by Vanuxem and Beck, "The exact place was upon the lawn now owned and occupied by Howard G. White. . . . The specimens that you have were gathered some time between 1837 and 1845, probably nearer the earlier period. We used to go to the bed sometimes with a pick (oftener not) to gather and sort out the specimens. They were found in a bed of decomposed green rock, which was soft, and readily gave way under the pick. This bed of green disintegrated rock extended all along the side of the hill from the middle of James Street, nearly to the place where Howard White's house was built. The specimens were, I think, all found at the north or James Street end. . . . *When a trench was opened for water-mains opposite, and near to this deposit of serpentine (about fifty feet away), the cutting was through gypsum.*" The outcrop has not been accessible for over forty years.

It will be readily seen that the main point of interest connected with this rock is its mode of origin, — whether aqueous or igneous. It is included between two beds of porous limestone or dolomite. Among the dozen or more specimens in the possession of the writer, there are some which show angular fragments of this limestone embedded in the serpentine. In one case these are so abundant as to afford a breccia with a serpentine matrix. By far the best proof of the eruptive nature of the rock from which the serpentine has been derived is, however, afforded by its microscopic structure. The hand specimens agree exactly with the descriptions of Vanuxem and Beck. There are two principal varieties,— one a compact, dark-green rock, in which a few bronzy crystals are seen; and a mottled one, occasionally stained with blood-red spots. A microscopical examination shows that both of these rocks are most typical representatives of the class known as peridotites; the former with a slightly, the latter with a very pronounced, porphyritic structure. The original structure is still perfectly preserved, although most of the constituents are changed to serpentine or a carbonate. The groundmass contains, beside these two minerals, magnetite, a brown mica peculiarly characteristic of certain peridotites, green amphibole, and yellowish octahedrons which may prove to be anatase. The porphyritic crystals have the typical crystal forms of olivine or enstatite, both so perfect and so sharp that they could only be the early crystallizations from a fluid magma. The blood-red spots are seen to be due to the common staining of altered olivine crystals by iron hydroxide. The more porphyritic specimens are doubtless from the edge of the mass, and the coarser-grained variety from its centre.

The evidence of the eruptive origin of the Syracuse serpentine appears, therefore, to the writer to be: 1°. The microscopic structure, which shows that the original mineralogical composition and arrangement of the rock were such as are only found in masses of an eruptive nature; 2°. The included fragments of the adjacent limestone; 3°. The last remark quoted from Wilkinson's letter, that fifty feet away, on the strike of the deposit, only gypsum was encountered.

There seems to be nothing in any of the published descriptions of this deposit which indicates that its origin was aqueous. Such an idea, expressed by both Vanuxem and Hunt, is purely a matter of opinion, unsupported by any facts.

The writer hopes soon to publish in more detail the results of his study of this rock. It seems to bear a strong resemblance to the carboniferous peridotites recently described from Kentucky by Mr. J. S. Diller, of the U. S. geological survey, — an opinion with which Mr. Diller himself wholly concurs.

GEORGE H. WILLIAMS.

Baltimore, Md., March 7.

## Thought-transferrence.

It is always a rash course to attack other people's work on the strength of second-hand reports of it, and doubly so when the reports have themselves been those of hostile critics. This rashness I am forced to impute to 'J. J.,' the writer of a paper on 'Some miscalled cases of thought-transferrence,' in your supplement for Feb. 4, as I cannot for a moment believe him capable of the deliberate *suppressio veri* and *suggestio falsi* which his attempt to explain our English results by 'number-habits' would otherwise involve. The idea that the argument for thought-transferrence has depended entirely, or mainly, on experiments in which one person chose a number at will, and another person tried to guess it, could not survive the most cursory study of the published evidence. Yet that idea, picked up by 'J. J.' from an article in the *National review*, is the one on which his own criticism is expressly and exclusively founded, and which every one of his readers, if unacquainted with the original evidence or some trustworthy version of it, must at this moment be holding.

As a matter of fact, this type of experiment (though, as I shall show, 'J. J.' has greatly exaggerated its defects) has hardly ever been employed by us, and its results are a negligible quantity in our case. Our published records do not include a single instance in which the object to be guessed was a single digit chosen by the agent. Where the number contains two digits, the risk of appreciable disturbance of the results by 'number-habit' is of course far less; and trials of this type form between a sixth and a seventh part of the tabulated Creery aggregate.[1]

But their importance in the cumulative result of those experiments is very much smaller than this fraction would indicate; since the success obtained in them, though very remarkable, was less so than in some other types. If 'J. J.' likes to omit them, one and all, as 'vitiated,' he is welcome to do so; and he will, at any rate, have the satisfaction of striking a certain number of noughts off the odds — estimated at about a hundred million trillions to 1 — against obtaining by accident the amount of success re-

[1] This aggregate consists of results where the object of which the idea was to be transferred was known only to some member or members of the investigating committee. See the table in 'Phantasms of the living,' vol. i. p. 25, as to which it should be noted, that in the experiments with single digits, included under the second head of Dublin experiments, the numbers were drawn at random out of a bag. Trials with "letters of the alphabet, and names of people and towns," by the way, find no place in this crucial list; but I am curious to know whether 'J. J.' would account, e.g., for the correspondences of names recorded on p. 27, by 'independent similar brain-functioning.'

corded. Our only other published instance of trials where double numbers were chosen, is that described in 'Phantasms of the living,' vol. i. p. 34; and here, as soon as we heard of certain remarkable results which were being obtained by two of our friends, we took the precaution (which 'J. J.' regards as beyond the capacity of such as us, though likely to occur to 'psychologists and writers on probabilities') of insisting that the numbers should be *drawn*, and not *chosen*, by the agent. This precaution has, of course, been invariable in our principal class of experiments, where the objects to be guessed have been playing-cards. Of two long series recorded in 'Phantasms' (vol. i. p. 34, and vol. ii. p. 654), where double numbers were similarly drawn, one gave as the total of completely correct guesses a result against the accidental occurrence of which the odds were over two millions to 1; the other, where account was taken of cases where the two right digits were guessed in reverse order, and of cases where one only of the digits was guessed rightly and in the right place, gives a total result against the accidental occurrence of which the odds were nearly two hundred thousand million trillion trillions to 1.

I have perhaps said enough to indicate the extent of 'J. J.'s' misrepresentation; but I may further briefly point out how defective his reasoning would be, even supposing that experiments of the sort attacked had really occupied the place in our evidence which he supposes. 1. His own remark, that the discovery of 'number-habit' was "brought about by noticing that quite constantly an undue number of successes occurred at the *beginning* of many sets of number-guessings," might have suggested to him how slightly it was likely to affect long series, where all the numbers appear again and again. To make out his case, he must get a few uninitiated persons each to write down a series of, say, fifty digits, and must ascertain by comparing the first, the second, the third items, and so on, of each pair of lists, whether the number of correspondences in each pair far exceeds the ten (one-tenth of the total), which is the theoretic most probable number, and, if so, how far such excess is connected with the predominance of one or two particular digits. How the correspondences could be produced by a '*varying* predilection for *different* numbers,' I must leave it to him, or the writers whom he quotes, to explain. 2. The cases he adduces where 'persons were asked to choose a number, *no limits being set*,' and then, as a rule, chose numbers under 20 or under 10, are quite irrelevant. We never, on any occasion, gave this unlimited choice, which would have precluded the knowledge of exactly what it was most essential to know, — the degree of probability that chance would produce the results obtained. 3. The fact that many people, when asked to choose a number with three figures, choose a number containing the digit 3, is quite irrelevant: for, in the first place, we have never experimented with numbers of three digits; and, in the second place, the fact that 3 sensibly predominates in a number of *first* choices does not even tend to suggest that it would sensibly predominate in a *series* of choices. 4. To experiments with double numbers (when chosen and not drawn), 'J. J.' objects that people are apt to choose multiples of ten with disproportionate frequency, and that they tend to choose numbers near the higher limit. A glance at the double-number results recorded in 'Phantasms of the living' (vol. i. p. 34) will show the futility of making a serious objection to them out of the slight preference[1] for multiples of ten; for the number of successes (obtained before the plan of drawing from a bowl was introduced) exceeded what chance was likely to give, even supposing that the agent's choices and the percipient's guesses *had throughout been restricted* to multiples of ten — restricted, that is, to nine out of the ninety numbers over which they freely ranged. As regards the alleged predilection for later numbers, I need only remark that in a series of any length it ceases to be apparent;[2] while, even if it continued, the later numbers in a set of ninety are sufficiently numerous to insure, at each trial, large odds against accidental success.

In conclusion, I cordially agree with 'J. J.' in recommending (as my colleagues and I have recommended publicly and privately times without number) such forms of experiment as leave the issue between chance and thought-transferrence perfectly clear. I am also glad to find him, and the writers whom he quotes, so completely sound on another point which I have specially urged, — the fallacy of extracting evidence for thought-transferrence from the frequent simultaneous utterances of thought and feeling by relatives and intimate associates. Such fallacies cannot be too often exposed; for telepathy suffers far more from friends who accept and proclaim it on insufficient grounds than from its most strenuous critics and opponents. Whether 'J. J.' would continue to hold *our* grounds insufficient, if he took the trouble to learn what they are, I cannot tell; meanwhile he must pardon my feeling a certain sense of alliance with one who so clearly perceives that the novel doctrine, though evidence may prove it, could never be proved by casual experiments or by loose, popular arguments. How soon the proof will be generally recognized as complete, depends on something which we, unfortunately, can neither foresee nor control, — the degree in which sympathy with our objects and methods takes the form of help.

By chance, I have only just seen *Science* for Jan. 21, in which I read that Dr. Minot has lately introduced some trick-experiments with cards as similar to some of our thought-transferrence trials. In Dr. Minot's cases the card was forced on the drawer by a confederate of the professing 'percipient.' In all our card-experiments the card was drawn at random from the pack by one of our own investigating group. For these cases to resemble Dr. Minot's, it would be necessary that the percipient, or some one connected with the percipient, should have held the pack while the card was drawn. To permit such a procedure would have implied a degree of incompetence on our part which it did not occur to us explicitly to disclaim. However, I take this opportunity of disclaiming it, by stating that the pack was invariably held by one of ourselves; almost always, in fact, by the person who made the draw.

Dr. Minot is further reported to have objected that "in many of the English experiments there existed

[1] I have just examined the details of 1,191 of these trials, which I have under my hand, and find that the cases where multiples of ten were chosen form rather more than an eighth, instead of a ninth, of the whole.

[2] I have examined three hundreds, taken at random, of the series just mentioned. In the first hundred, 53 of the numbers chosen were nearer the higher limit than the lower; in the second and the third hundred, 55 were nearer the lower limit.

evident opportunities for fraud." Quite true — not in many only, but in all; and not only in psychical but in physical experiments of all sorts, which people accept without verifying the results for themselves. But *whose* fraud? We have always been content to rely on the very large class of cases in which the fraud would have had to be *our own*, — fraud in which the investigators actively shared, not merely which they failed to detect. I am far from saying that Dr. Minot or any one else is bound to accept this condition as crucial. But it is surely obvious that he who carries his experiments to the point where they can only be impugned by impugning his good faith, has done — as far as the *quality* of his results is concerned — all that any experimenter in any branch of science ever can do. Nothing remains, after this, but to try to increase the *quantity* of the results, whereby the responsibility for them may be spread over other shoulders.

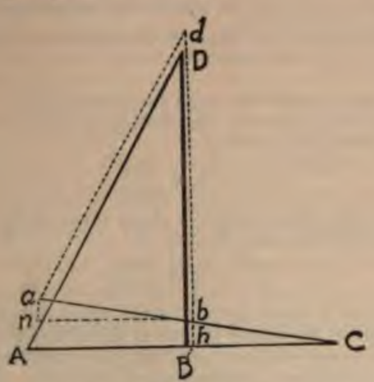
EDMUND GURNEY.

London, Feb. 17.

## On tiptoe.

About two years ago Mr. F. A. Pond requested me to work out for him the problem of the human foot regarded as a lever. He thought the essential feature of the case — namely, the attachment of the calf-muscle to the leg below the knee, as well as to the heel, by a tendon — had been ignored.

The question has been of interest to a number of people; and it may be well to bring the true state of the case before writers on anatomy and physiology, inasmuch as it appears to be generally stated that the foot is a lever of the second order when used in rising 'on tiptoe.'




It will do to assume the change of position so small that the foot may be treated as a straight lever. Let $A\ B\ C$ be the foot-lever: $A$, the point of attachment of tendon to heel; $B$, the ankle pivot; and $C$, the point where the foot rests upon the ground. At $B$ erect a perpendicular, $BD$, to represent the leg-bones, the calf-muscle being attached at $D$. Now let the muscle contract, and raise $B$ to $b$. The work done is equal to the weight of the body (supposing one foot used) multiplied by the perpendicular distance through which $B$ is raised, that is, $bh$ of the figure. The power exerted by the muscle is equal to its pull multiplied by the diminution of the distance $AD$. As $B$ rises to $b$, let $A$ rise to $a$, and $D$ to $d$. Through $b$ draw $bn$ parallel to $AC$, and drop $an$. Now, $bC$ is to $bh$ as $ba$ is to $an$. The line $an$ is very approximately the amount of shortening of the muscle. The sign of the 'mechanical advantage' will be positive, zero, or negative, according as $AB$ is greater than, equal to, or less than, $BC$. A lever of the 'second order' implies advantage of positive sign; that is, so-called 'mechanical advantage.' A lever of the 'third order' implies mechanical disadvantage. A lever of the 'first order' is capable of affording mechanical advantage or mechanical disadvantage, as the ratio of the arms determines: hence, when one rises on tiptoe, the foot is a lever of the first order.

An attempt has been made to regard the case as of the second order, by calling the upward pull at $A$, $y$, and the pressure of the body at $B$, $x$. The pull $y$ will be transferred as a downward thrust of $y$ to $B$; so that we have (if, for instance, $AB = BC$) an upward force of $y$ at $A$, and a downward force of $x + y$, equal to $2y$, at $B$. But the traverse of $y$ is not twice the traverse of $2y$. Thus the 'principle of work' limits the case to the 'first order.'

F. C. VAN DYCK.

New Brunswick, N.J., Feb. 28.

## Increase of the electrical potential of the atmosphere with elevation.

Very many observations of the electrical potential of the atmosphere have been made at different places in this country during the past year, under the auspices of the U.S. signal office. Among others, at Washington, D.C., a series of simultaneous observations has been carried on at the instrument room of the signal office and at the top of the Washington monument, the highest known edifice. The object of the present paper, published by permission of the chief signal officer, Gen. A. W. Greely, is to present in brief some of the results of those observations, particularly those bearing on the value of the intensity of the electrical force of the atmosphere at an elevation of five hundred feet, and the variations of the potential under different conditions of weather.

Beccaria, De Romas, Henley, and Cavallo, all noticed that the more elevated the position of the collecting apparatus, the greater the degree of electrification. Schübler (*Schweigg. journ.* ix. 348) was the first to make measurements of the difference, and found that a positive electrification increased, at least up to a height of 50.5 metres. His results with an electroscope were as follows: —

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Height (metres).......... | 9.7 | 16.2 | 24.4 | 47.1 | 49.4 | 55.6 | 58.5 |
| Deflection (degrees)..... | 15 | 20 | 26 | 50 | 53 | 58 | 64 |

Sir William Thomson, it is sometimes stated, found an increase of from 200 to 300 volts for three metres. This value, however, was one obtained with a portable electrometer on a flat open sea-beach on the island of Arran, the height of the match being nine feet above the earth. The readings varied from 200 to 400 volts, so that "the intensity of electric force, perpendicular to the earth's surface, must have amounted to from 22 to 44 Daniell elements per foot of air" (Thomson, reprint of papers, xvi 281). It is also intimated that on other dates this value might have been twice as large, or yet much smaller. Mascart and Joubert found that if two water-collectors were placed in the same vertical line, the one five, the other ten metres high, the indications were in the main alike, and in the ratio of 1 to 2. Some experi-

ments made by me in May, 1886, confirm this general statement, although the actual values would vary greatly from day to day. Thus, with two collectors, on one date I obtained as mean values, for 80 feet elevation, 150 volts; for 55 feet elevation, 40 volts; while on another date the values for the same elevations were respectively 300 volts and 100 volts.

Professor Exner (*Repertorium der Physik*, xxii. heft 8, 451) gives the results of some experiments of a similar nature made about the same time, which show the potential gradient to be of uncertain value, and influenced largely by the proximity of buildings and walls. The following values for the potential were obtained with a water-dropper in an enclosed court: —

| | | | | | | |
|---|---|---|---|---|---|---|
| Two metres from wall | Height (metres)..... | 0 | 5 | 10 | 15 | 20 |
| | Potential (volts)..... | 0 | 2 | 7 | 17 | 48 |
| In centre of court..... | Height (metres)..... | 0 | 5 | 10 | 15 | 20 |
| | Potential (volts)..... | 0 | 5 | 11 | 32 | 68 |

From measurements made with small balloons filled with hydrogen gas, Exner obtained, for the potential in free air, these values: —

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Height (met.) | 17 | 18 | 20 | 21 | 22 | 24 | 25 | 27 | 30 | 34 | 40 | 48 |
| Poten. (volts) | 100 | 110 | 120 / 140 | 130 | 160 | 160 | 160 | 170 | 195 / 210 | 250 | 280 | 350 |

from which

$$F = \frac{d\,V}{d\,n} = 6.8\,\frac{\text{volt}}{\text{metre}}.$$

These values were obtained with a burning match. According to Pellat (*Comptes rendus*, c. 1885), the collecting efficiency of the match, compared with water-dropper and flame, is in the ratio of 1 to 5 to 10; so that, for comparison with the observations made here, where a water-dropping collector is employed, we have as a value for the electric force, during calm fine weather,

$$F = 34\,\frac{\text{volt}}{\text{metre}}.$$

Another set of observations, made on an exposed mountain-side, gave these results: —

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Height (metres) | 3 | 5 | 6 | 7 | 12 | 14 | 18 | 19 | 20 | 25 | 30 |
| Potential (volts) | 110 | 140 / 150 | 210 | 230 / 250 | 380 / 405 | 480 | 520 / 550 | 550 | 660 | 820 | 970 |

or there is a linear potential gradient, but with a higher value than in the preceding experiments. Supposing a water-dropper to have been employed instead of flame as the collecting agency, we have the value

$$\frac{d\,V}{d\,n} = 159\,\frac{\text{volt}}{\text{metre}}.$$

It is evident, then, that this value of the electrical force of the atmosphere is uncertain, and determined largely by local surroundings. It is also further affected by the conditions of temperature and relative humidity, and, as intimated, by inconstancy of the collecting agency. In working toward that 'electro-geodesy' which Sir William Thomson has proposed, we must determine and allow for these and doubtless other influences. By taking the mean of many observations made at different times, the influences of temperature and humidity are to some extent avoided. As said above, the following observations were made simultaneously, in 1886–87, at the top of the monument, 500 feet above the ground, and at the signal office, at an elevation of 50 feet. The instruments used were modified Mascart electrometers, and large water-droppers with nozzles of the same size. Similar methods and adjunct apparatus were employed at both places. The values in the following table appear to be too small, judging from the results quoted above. But it is to be remembered that these observations are made in both cases from buildings, and the points in air at which the collecting stream breaks away are not very distant from the side of the building.

*Values of electric force of the atmosphere.*

| Date. | Number of observations. | Mean value of potential. Monument. | Mean value of potential. Signal office. | Difference for 450 feet. |
|---|---|---|---|---|
| | | *Volts.* | *Volts.* | *Volts.* |
| June 26, " 27, " 28 | 399 consecutive 5-minute observations | 289 | 134 | 155 |
| July 17 | 60 | 1129 | 93 | 1036 |
| " 20 | 107 | 389 | 70 | 319 |
| Sept. 21 | 40 | 212 | 107 | 105 |
| Oct. 4 | 94 | 586 | 192 | 394 |
| " 5 | 82 | 300 | 108 | 192 |
| " 7 | 97 | 435 | 112 | 323 |
| " 14 | 87 | 140 | 24 (*a*) | 116 (*a*) |
| Nov. 1 | 4 (*b*) | 1137 | 265 | 872 |
| " 3 | 98 | 943 | 248 | 695 |
| " 12 | 15 | −849 (*c*) | −245 (*c*) | −604 (*c*) |
| " 12 | 65 | 458 | 36 | 422 |
| Dec. 15 | 13 | 487 | 4 (*d*) | 483 (*d*) |
| Jan. 29 | 26 | 413 | 141 | 272 |
| Feb. 9 | 54 | 1825 | 89 | 1736 |

(*a*) On this date some of the values at the lower station were below the zero, i.e., negative: 69 observations gave positive indications, averaging 38 volts, and 18 observations gave negative values, averaging 31 volts. The negative values have been subtracted from the positive, and the remainder divided by the total number of observations.
(*b*) Not simultaneous.
(*c*) At both stations during rain the observations continued for some little while negative.
(*d*) As in (*a*).

We have, therefore, from the above table, a mean value of the potential for the top of the monument of 637 volts, and a value of

$$\frac{d\,V}{d\,n} = 4.33\,\frac{\text{volt}}{\text{metre}};$$

and at the lower station a mean value of the potential of 124 volts and a value of

$$\frac{d\,V}{d\,n} = 8.43\,\frac{\text{volt}}{\text{metre}}.$$

Therefore it would seem that the mean value of the potential at the upper station is about five times that at the lower station. Among the observations, I find one striking confirmation of this ratio. On Nov. 3, 1886, if we multiply the results obtained at the lower station by 5, we shall obtain approximately a duplicate of those at the upper elevation; this for a series extending from 11 A.M. until 3 P.M. In some respects this date was most satisfactory, being a dry, somewhat hazy, autumn day, with light southerly winds, and sky about half covered with ill-defined cirro-stratus clouds. The electrification at the top of the monument was sufficient to give a spark a millimetre in length.

These experiments were begun under the direction of Prof. T. C. Mendenhall, to whom, and to Col. T. L. Casey, of the Engineer corps, U.S.A., more than acknowledgment of kindness is due.

ALEXANDER MCADIE, M.A.

## Calendar of Societies.

*Anthropological society, Washington.*

*March* 1. — Thomas Wilson, Megalithic monuments of Brittany; Discussion upon Mr. Wallace's paper, Social *versus* political economy.

*Biological society, Washington.*

*March* 5. — P. L. Jouy, Corea, the country and the people; Frank Baker, Notes on some unusual muscular variations; T. H. Bean, European and American work in deep-sea ichthyology; C. Hart Merriam, Contributions to North American mammalogy; Description of a new species of Evotomys; H. G. Beyer, Remarks on the preservation of bottled museum specimens.

*Engineers' club, Philadelphia.*

*Feb.* 19. — John Fernie, The mechanical genius and works of the late Sir Joseph Whitworth.

*Institute of social science, New York.*

*March* 10. — Simon Sterne, Free trade.

*Appalachian mountain club, Boston.*

*March* 9. — W. M. Davis, Results of meteorological observations at Appalachian club stations, in the White Mountains, during the winter of 1886–87; F. H. Chapin, Ascent of Mont Blanc.

*Society of arts, Boston.*

*March* 10. — Stuart M. Buck, Coal-mining, with a review of the more recent experiments on the action of dust in colliery explosions.

*Engineers' club, St. Louis.*

*March* 2. — Robert Moore, Present aspects of the problem of inter-oceanic ship-transfer.

**Publications received at Editor's Office, Feb. 28–March 5.**

Ashburner, C. A. Coal. Washington, Government. 73 p. 8°.

Baker, I. O. Leveling; barometric, trigonometric and spirit. New York, Van Nostrand. 145 p. 24°. 50 cents.

Barnard, J. G. Analysis of rotary motion, as applied to the gyroscope. New York, Van Nostrand. 66 p. 24°. 50 cents.

Bastable, C. F. The theory of international trade, with some of its applications to economic policy. Dublin, Hodges, Figgis & Co. 176 p. 12°.

Bemis, E. W. Coöperation in New England. Baltimore, Amer. econom. assoc. 136 p. 8°.

Bryans, C. Gai Iuli Caesaris de bello Gallico, commentariorum iv. New York, Macmillan. 112 p. 24°. 40 cents.

Crosby, W. O. Geological collections. Mineralogy. Boston, Soc. nat. hist. 184 p. 12°.

Dana, J. D. Manual of mineralogy and petrography. 4th ed. New York, Wiley. 517 p. 12°.

Elson, L. C. Home and school songs: an illustrated song book for children. Chicago, Interstate publ. co. 64 p. 8°. 40 cents.

Fox, C. B. Sanitary examinations of water, air, and food. 2d ed. Philadelphia, Blakiston. 563 p. 12°. $4.

Goebel, K. Outlines of classification and special morphology of plants. Oxford, Clarendon pr. 515 p. 8°. (New York, Macmillan, $5.25.)

Henry, Joseph, scientific writings of. Vols. i. and ii. Washington, Smithson. inst. 523+559 p. 8°. $5.

Ramsay, G. G. Selections from Tibullus and Propertius. Oxford, Clarendon pr. 380 p. 16°. (New York, Macmillan, $1.50.)

Rawlins, F. H. The last two kings of Macedon. Extracts from the fourth and fifth decades of Livy. New York, Macmillan. 215 p. 16°. $1.

Shufeldt, R. W., contributions to science and bibliographical résumé of the writings of, 1881–87. New York, L. S. Foster. 20 p. 8°.

United States, mineral resources of the, 1885. Washington, Government. 576 p. 8°.

Verrall, A. W. The 'Seven against Thebes' of Aeschylus. New York, Macmillan. 179 p. 8°. $2.

# SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 11, 1887.

## *THE CHARACTERISTIC CURVES OF COMPOSITION.*

AUGUSTUS DEMORGAN somewhere remarks (I think it is in his 'Budget of paradoxes') that some time somebody will institute a comparison among writers in regard to the average length of words used in composition, and that it may be found possible to identify the author of a book, a poem, or a play, in this way.

In reflecting upon this remark at various times within the past five or six years, always with the determination to test the value of the suggestion whenever time for the work seemed available, a more comprehensive and satisfactory method of analysis than that based simply upon mean word-length suggested itself. The new method, while scarcely more laborious than that proposed by DeMorgan, promised to yield results more quickly and of a definitely higher order. It also had the advantage of including, in its application, all that was necessary to the determination of mean word-length; so that, in reality, it furnished two distinct tests.

Preliminary trials of the method have furnished strong grounds for the belief that it may prove useful as a method of analysis leading to identification or discrimination of authorship, and it is therefore brought to the attention of the scientific and literary public in the hope that some one may be found who is at once able and willing to secure a satisfactory test of its validity.

The nature of the process is extremely simple, but it may be useful to point out its similarity to

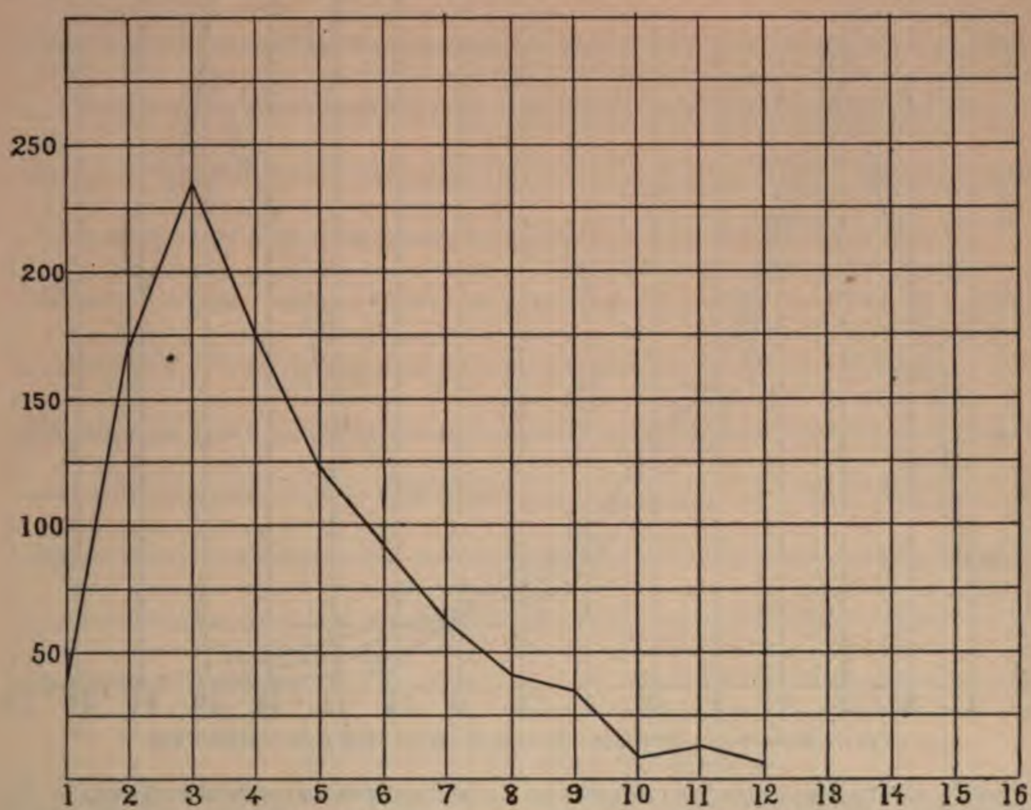



FIG. 1.—FIRST ONE THOUSAND WORDS IN 'OLIVER TWIST.'

a well-known method of material analysis, the consideration of which actually first suggested to the writer its literary analogue.

By the use of the spectroscope, a beam of non-homogeneous light is analyzed, and its components assorted according to their wave-length. As is well known, each element, when intensely heated under proper conditions, sends forth light which, upon prismatic analysis, is found to consist of groups of waves of definite length, and appearing in certain definite proportions. So certain and uniform are the results of this analysis, that the appearance of a particular spectrum is indisputable evidence of the presence of the element to which it belongs.

In a manner very similar, it is proposed to analyze a composition by forming what may be called a 'word-spectrum,' or 'characteristic curve,' which shall be a graphic representation of an arrangement of words according to their length and to the relative frequency of their occurrence. If, now, it shall be found that with every author, as with every element, this spectrum persists in its form and appearance, the value of the method will be at once conceded. It has been proved that the spectrum of hydrogen is the same, whether that element is obtained from the water of the ocean or from the vapor of the atmosphere. Wherever and whenever it appears, it means hydrogen. If it can be proved that the word-spectrum or characteristic curve exhibited by an analysis of 'David Copperfield' is identical with that of 'Oliver Twist,' of 'Barnaby Rudge,' of 'Great expectations,' of the 'Child's history of England,' etc., and that it differs sensibly from that of 'Vanity fair,' or 'Eugene Aram,' or 'Robinson Crusoe,' or 'Don Quixote,' or any thing else in fact, then the conclusion will be tolerably certain that when it appears it means Dickens.

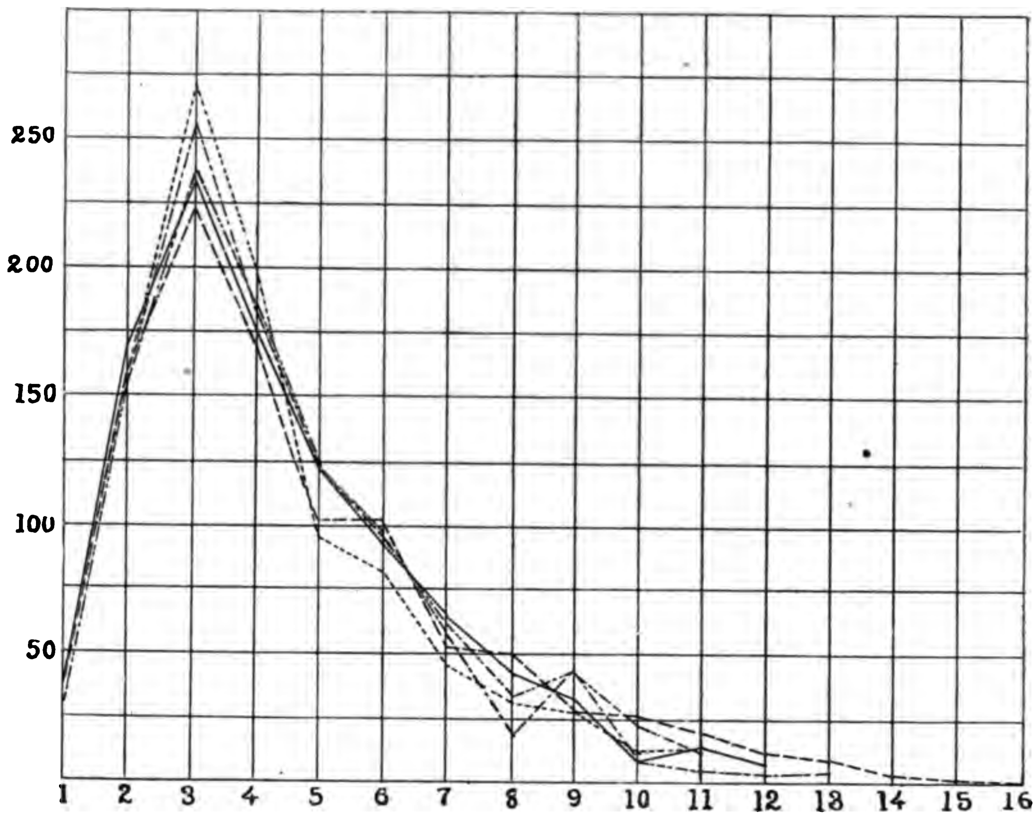



FIG. 2.—SHOWING FIVE GROUPS, OF ONE THOUSAND WORDS EACH, FROM 'OLIVER TWIST.'

The validity of the method as a test of authorship, then, implies the following assumptions: that every writer makes use of a vocabulary which is peculiar to himself, and the character of

which does not materially change from year to year during his productive period; that, in the use of that vocabulary in composition, personal peculiarities in the construction of sentences will, *in the long-run*, recur with such regularity that short words, long words, and words of medium length, will occur with definite relative frequencies.

The first assumption will, perhaps, be admitted in a general way, without debate. It is easily seen that to prove or disprove the second will require the expenditure of an enormous amount of labor. The following results are offered as a means of properly exhibiting the method, and as evidence, in some degree at least, of its real value.

It is important, first, to determine to what extent an author may be said to agree with himself; and, second, to what extent does he differ from others.

As an instance in which two writers might well be expected to greatly resemble each other in their curves, and consequently as a severe test of the method, two contemporaneous novelists, Dickens and Thackeray, were selected for the first examination. The operation consisted simply in counting the number of letters in every word, and recording the number of words of one letter, two letters, three letters, etc. The count began in both cases at the beginning of the volume, and, after a few thousand words had been counted in order, the book was opened at random near the middle, and the count continued. In no case was any personal choice exercised, except that both counts began with the first chapter. Words were counted always in groups of one thousand. The graphic display of the result was made by the common method of rectangular co-ordinates, using the number of letters in a word as an abscissa, and the corresponding number of such words in a thousand as an ordinate. As an illustration, the first one thousand words counted from 'Oliver Twist' may be cited; they were as follows: —

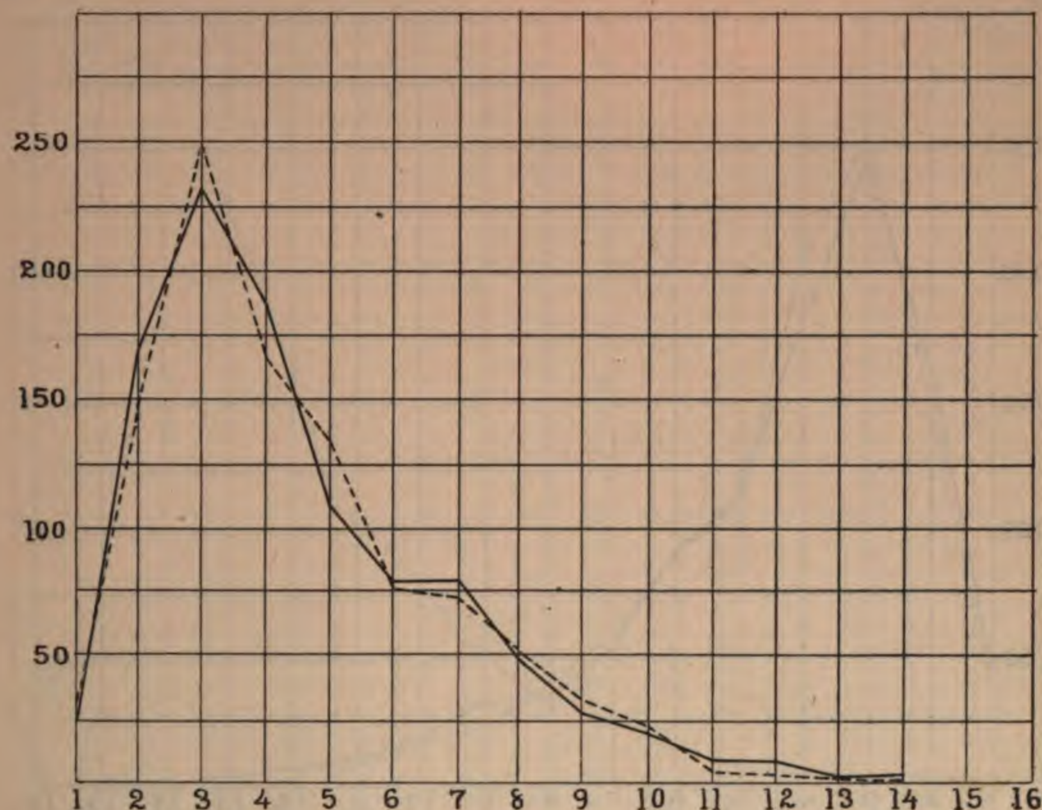



FIG. 3.—TWO CONSECUTIVE GROUPS, OF ONE THOUSAND WORDS EACH, FROM 'VANITY FAIR.' THESE GROUPS SHOW SENSIBLY THE SAME AVERAGE WORD-LENGTHS.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of letters | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Number of words | 38 | 170 | 235 | 175 | 123 | 91 | 62 | 41 | 35 | 10 | 13 | 7 |

Even in so small a number as one thousand, the relative distribution of words is approximately the same as in a much larger number, although, as would naturally be expected, accidental variations or 'runs' overshadow personal characteristics to a great extent; but not completely, as will be seen in the characteristic curves shown in the following pages. In fact, when the ten groups, of a thousand words each, from Dickens, are compared with ten similar groups from John Stuart Mill, no one of the first set could by any possibility be mistaken for any one of the second.

The graphic representation of the results will be readily understood. It is only necessary to take a sheet of 'squared' paper, or paper ruled in two directions at right angles to each other, and, after placing the numbers showing letters in each word at points along a horizontal line separated from each other by equal distances, above each of these place other points whose distance from the base line shall be proportional to the number of such words in a thousand; then join these points by a broken line, and the characteristic curve is shown. Fig. 1 shows the curve thus constructed from the first thousand words in 'Oliver Twist,' the numerical analysis of which is shown above.

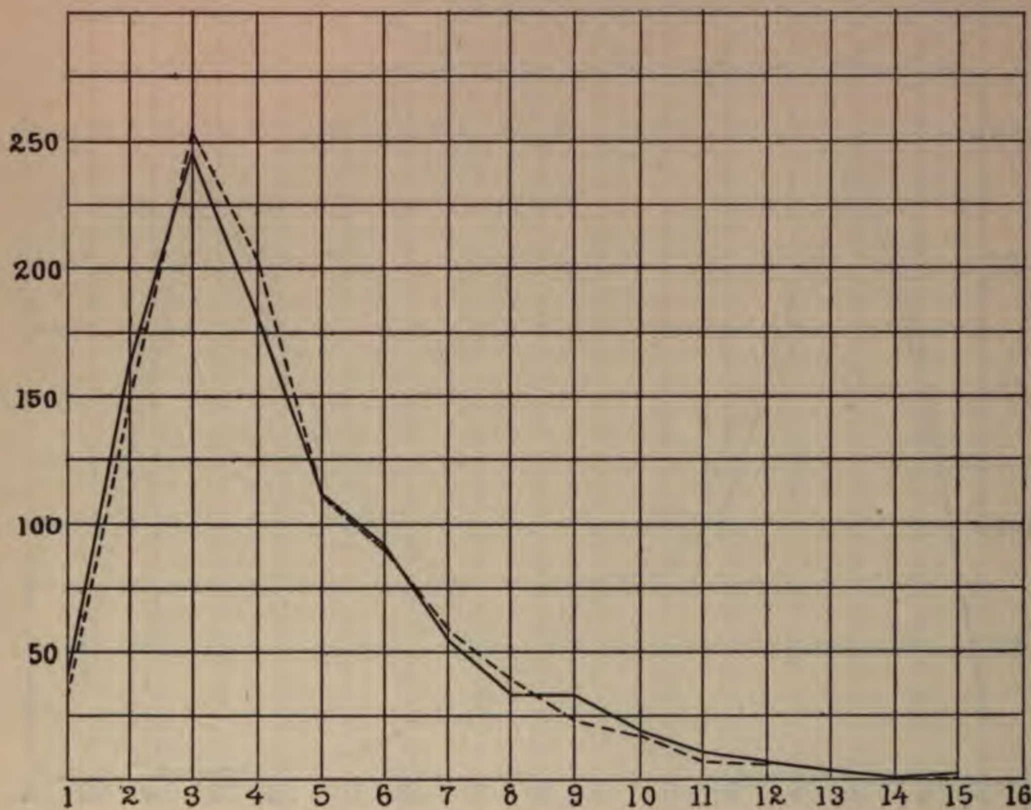



Fig. 4.—Two groups, of five thousand words each, from 'Oliver Twist.'

The next diagram (fig. 2) exhibits five curves constructed from the first five thousand words the same from work, in groups of one thousand each. It is presented in order to show the variation among groups based on a relatively small number of words.

The superiority of this method over that of simple word averages, as suggested by DeMorgan, is clearly shown in fig. 3, which exhibits two consecutive groups, of one thousand words each, from 'Vanity fair.' The numerical analysis of these groups is as follows:—

| Letters | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Words in 1st group | 25 | 169 | 232 | 187 | 109 | 78 | 79 | 48 | 28 | 20 | 10 | 10 | 2 | 3 |
| Words in 2d group | 33 | 146 | 248 | 164 | 135 | 76 | 73 | 52 | 35 | 23 | 6 | 5 | 2 | 2 |

It will be seen that the total number of letters in the first group is 4,507, and in the second 4,508, or an average of 4.507 and 4.508 letters to each word in the respective groups. If this average, or 'mean word-length,' be alone considered, the two groups must be regarded as sensibly identical; but an inspection of the diagram shows that they are in reality quite different.

When the number of words in a group is increased to five thousand, the accidental irregularities begin to disappear, the curve becomes smoother, approximating more nearly to the normal curve which, it is assumed, is characteristic of the writer. Fig. 4 exhibits two groups, each of five thousand words, from 'Oliver Twist,' and it will be seen that considerable differences still exist. One of the curves shows an excess of nine-letter words, which does not appear in the other. They agree in showing a greater number of six-letter words than a smooth curve would demand. This excess may persist, and prove to be a real characteristic of Dickens's composition. Fig. 5 exhibits these two groups of five thousand words combined in one of ten thousand, giving a curve of greater smoothness, and approximating still more closely to the normal curve of the writer.

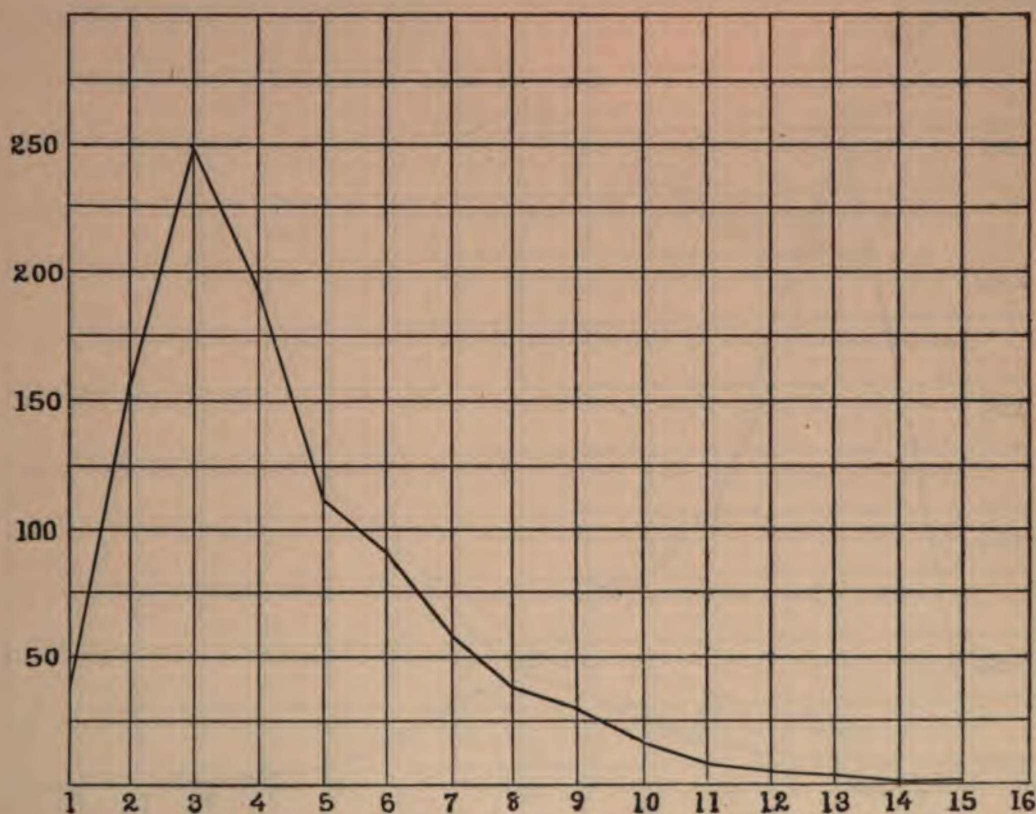



FIG. 5.—CURVE FOR TEN THOUSAND WORDS FROM 'OLIVER TWIST.'

In fig. 6, two groups of five thousand words each, from 'Vanity fair,' are shown; and in fig. 7, two groups of ten thousand each, from 'Oliver Twist' and 'Vanity fair,' are placed side by side for comparison, the former being represented by the continuous line, and the latter by the broken line. Although these curves differ, and while it is believed that the difference will persist with an increased number of words, it is certainly surprising, that in the analysis of ten thousand words from Dickens, and the same number from Thackeray, so close an agreement

should be found. This agreement is particularly striking in words of eleven, twelve, and thirteen letters, the numerical comparison of which is as follows: —

| | | | |
|---|---|---|---|
| Number of letters | 11 | 12 | 13 |
| Number of words in Dickens | 85 | 57 | 29 |
| Number of words in Thackeray | 85 | 59 | 29 |

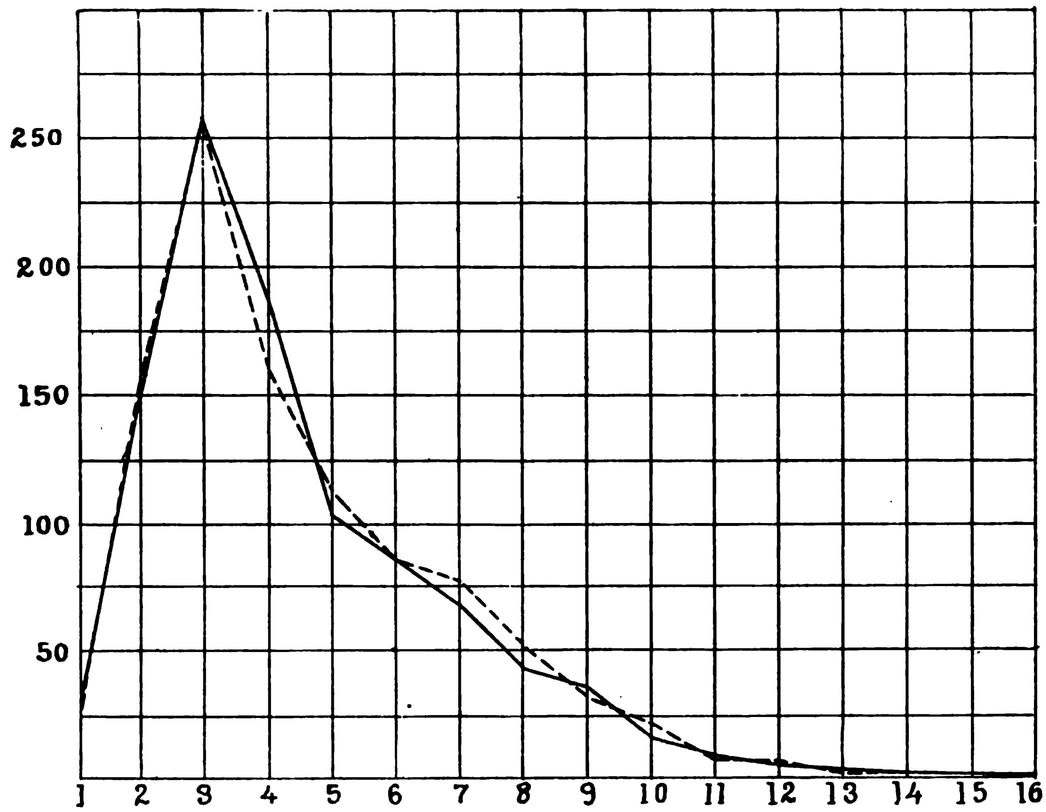



FIG. 6. — TWO GROUPS, OF FIVE THOUSAND WORDS EACH, FROM 'VANITY FAIR.'

This closeness to identity must be largely the result of accident, and it would not be likely to repeat itself in another analysis.

The writer next examined was John Stuart Mill; and to test the persistence of form in compositions belonging to different periods of the author's life, and upon different subjects, two groups of five thousand words each were taken, — one from his 'Political economy,' and the other from his 'Essay on liberty.' It was anticipated, of course, that words of greater length would occur far more frequently than in the case of the novelists; but I confess to considerable surprise on finding from the very beginning, that although, on the whole, this anticipation was realized, the word which occurred most frequently was not the three-letter word, as with both Dickens and Thackeray, but the word of two letters. Indeed, the word of two letters was not only relatively more frequent, but absolutely; that is to say, it occurred more frequently in the composition of Mill than in that of either of the novelists, and with great uniformity, as it was in excess in each thousand of the ten analyzed. The explanation is easy, and is to be found in the liberal use of prepositions in sentence-building. The proposed method of analysis is designed to reveal any peculiarity of this kind, and the exemplification of its power thus early in the work was encouraging.

Figs. 8 and 9 show the curves for five thousand words from the 'Political economy' and from the 'Essay on liberty.' It will be observed, that, while they differ considerably, there is still, in a general way, a striking resemblance, and that

they are in marked contrast with the curves of the novelists. An interesting case was furnished in two recent addresses on the labor question by Mr. Edward Atkinson. In reality, one address was given to two very different audiences. One was made up from the workingmen of Providence, and the other from the alumni of the Andover theological seminary. On reading the two, one cannot avoid being struck by the marked difference in style, although the two papers are much alike in substance. It was interesting, then, to inquire whether their curves of composition would show any marked resemblance. An analysis of five thousand words from each paper was made, and the result is shown in fig. 10. A very satisfactory, indeed a striking, general resemblance will be observed; and it will also be seen that Mr. Atkinson's curve differs decidedly from others previously figured and described. It is shown in contrast with that of John Stuart Mill in fig. 11. Mr. Atkinson's composition is remarkable in respect to the shortness of the words used. The average length of ten thousand words in his addresses on the labor question is 4.298 letters. The mean word-length of the writers thus far examined, based upon a count of ten thousand words from each, is as follows: —

| | |
|---|---|
| Atkinson | 4.298 |
| Dickens | 4.342 |
| Thackeray | 4.481 |
| Mill | 4.775 |

A friend has furnished me with the result of the count of the first five thousand five hundred words of Caesar's 'Commentaries.' The mean word-length is 6.065. The most extensive word-counting that I know of is that of the words and letters in the Bible. I cannot vouch for the reliability of the information which periodically floats through the columns of the public press, that the Old Testament contains 592,493 words with 2,728,100 letters, and the New Testament 181,253 words with 838,380 letters. It is interesting to note, however, that these numbers give averages of 4.604 and 4.625 respectively, agreeing within less than one-half of one per cent.

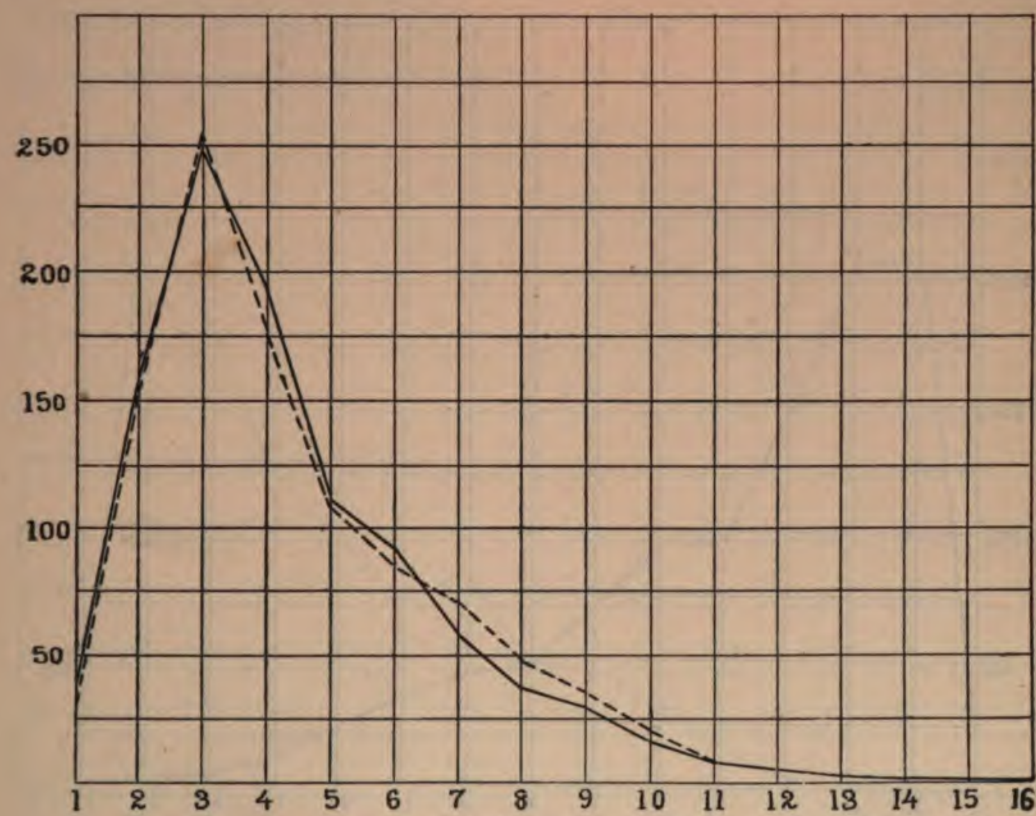



FIG. 7. — TWO GROUPS, OF TEN THOUSAND WORDS EACH, FROM 'OLIVER TWIST,' ——; AND FROM 'VANITY FAIR,' — — — —.

Before making an analysis of Mr. Atkinson's composition, and after having counted more than thirty thousand from other writers, I had concluded that a group of one thousand words whose average length was less than four letters would not occur, except in compositions especially written in short words. Out of ten such groups from Mr. Atkinson's addresses, however, one was found whose mean word-length was 3.991. I have recently received from him a brief paper, entitled 'How do we all get a living?' which was published in *Work and wages*, and in the preparation of which he made a special effort to use the simplest language possible. The article contains a little more than two thousand words, the number being too small for the construction of a curve which would be comparable with those already exhibited. The general form of one based upon two thousand words is similar to that previously obtained from the same writer, and the mean word-length is 3.771.

Interesting evidence of the validity of this method of analysis and identification has been furnished by several friends who have had the patience to enumerate the letters in many thousand words from different sources. Prof. Stanley Coulter sends me the result of a count of ten thousand from Dickens's 'Christmas carol.' He writes, "I became exceedingly interested in watching how little tricks of composition affected the 'curve.' For instance, one of the characters, 'Scrooge,' appears in one place very often, and an excess of 7's is the result: in another place 'Fizziwig,' and the 8's creep up [this is doubtless owing to the frequent appearance of the names]. Other variations and excesses seem to come from Dickens's love of certain forms of description, which he iterates and reiterates upon a single page."

I have plotted these ten thousand words from the 'Carol' with the ten thousand already shown from 'Oliver Twist,' in fig. 12. A very close resemblance will be observed, and it will be noticed that the *mean* of these two curves would be free from certain irregularities which occur in both,

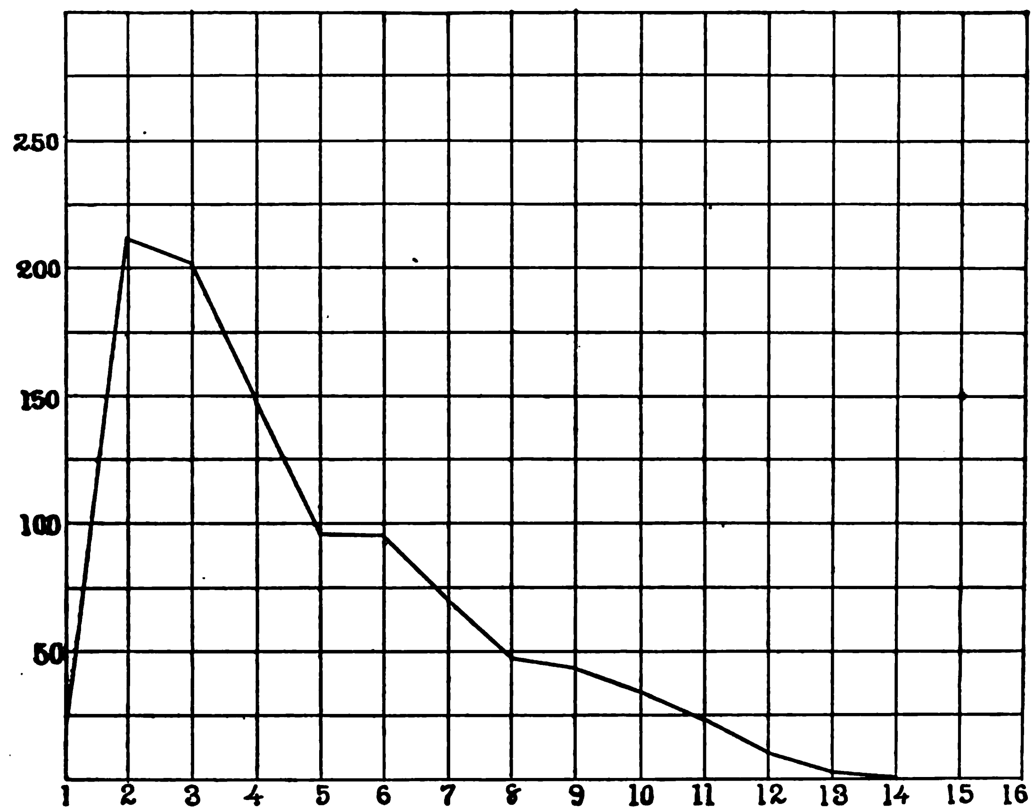



FIG. 8. — CURVE OF FIVE THOUSAND WORDS FROM MILL'S 'POLITICAL ECONOMY.'

and would be a much closer approximation to the normal characteristic curve of Dickens.

It is hardly necessary to say that the method is not necessarily confined to the analysis of a composition by means of its mean word-length: it may equally well be applied to the study of syllables, of words in sentences, and in various other ways. The results thus far obtained from its application would appear to justify the claim that it is worthy of a thorough test through which the validity of its assumptions might be proved or disproved. Its principal merits are, that it offers a means of investigating and displaying the mere mechanism of composition, and that it is purely mechanical in its application. In virtue of the first, it might reveal characteristics which a writer would make no attempt to conceal, being himself unaware of their existence; and, of the second, the conclusions reached through its use would be independent of personal bias, the work of one person in the study of an author being at once comparable with that of any other.

Many interesting applications of the process will suggest themselves to every reader; the most notable, of course, being the attempt to solve questions of disputed authorship, such as exist in reference to the letters of Junius, the plays of Shakspeare, and other less widely known examples. It might also be utilized in comparative language studies, in tracing the growth of a language, in studying the growth of the vocabulary from childhood to manhood, and in other directions too numerous to be catalogued. An illustration of its application to another language is shown in the analysis of more than five thousand words in Caesar's 'Commentaries,' already referred to, which is represented in fig. 13. The curve shows a relatively large use of long words, and its peculiar feature is the evident indication of two maximum ordinates nearly equal to each other.

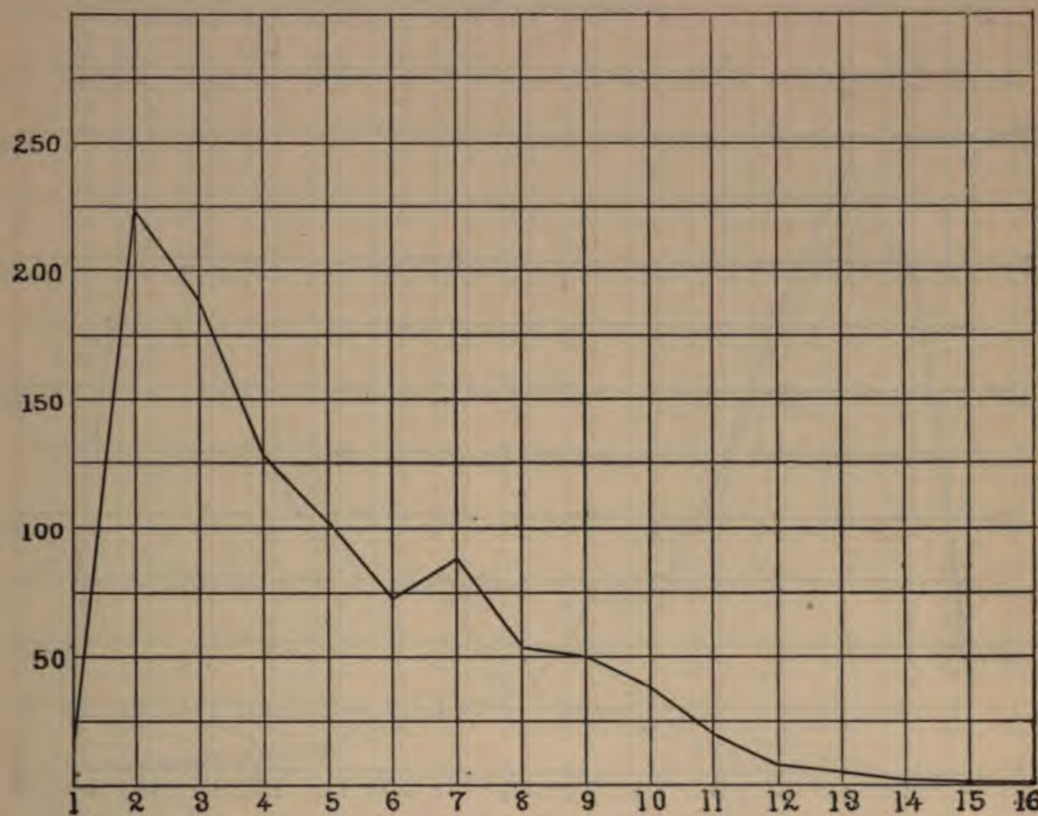


FIG. 9. — CURVE OF FIVE THOUSAND WORDS FROM MILL'S 'ESSAY ON LIBERTY.'

From the examinations thus far made, I am convinced that one hundred thousand words will be necessary and sufficient to furnish the c-

teristic curve of a writer, — that is to say, if a curve is constructed from one hundred thousand words of a writer, taken from any one of his productions, then a second curve constructed from another hundred thousand words would be practically identical with the first, — and that this curve would, in general, differ from that formed in the same way from the composition of another writer, to such an extent that one could always be distinguished from the other. To demonstrate the existence of such a curve will require the enumeration of the letters in several hundred thousand words from each of a number of writers. Should its existence be established, the method might then be applied to cases of disputed authorship. If striking differences are found between the curves of known and suspected compositions of any writer, the evidence against identity of authorship would be quite conclusive. If the two compositions should produce curves which are practically identical, the proof of a common origin would be less convincing; for it is possible, although not probable, that two writers might show identical characteristic curves.

T. C. Mendenhall.

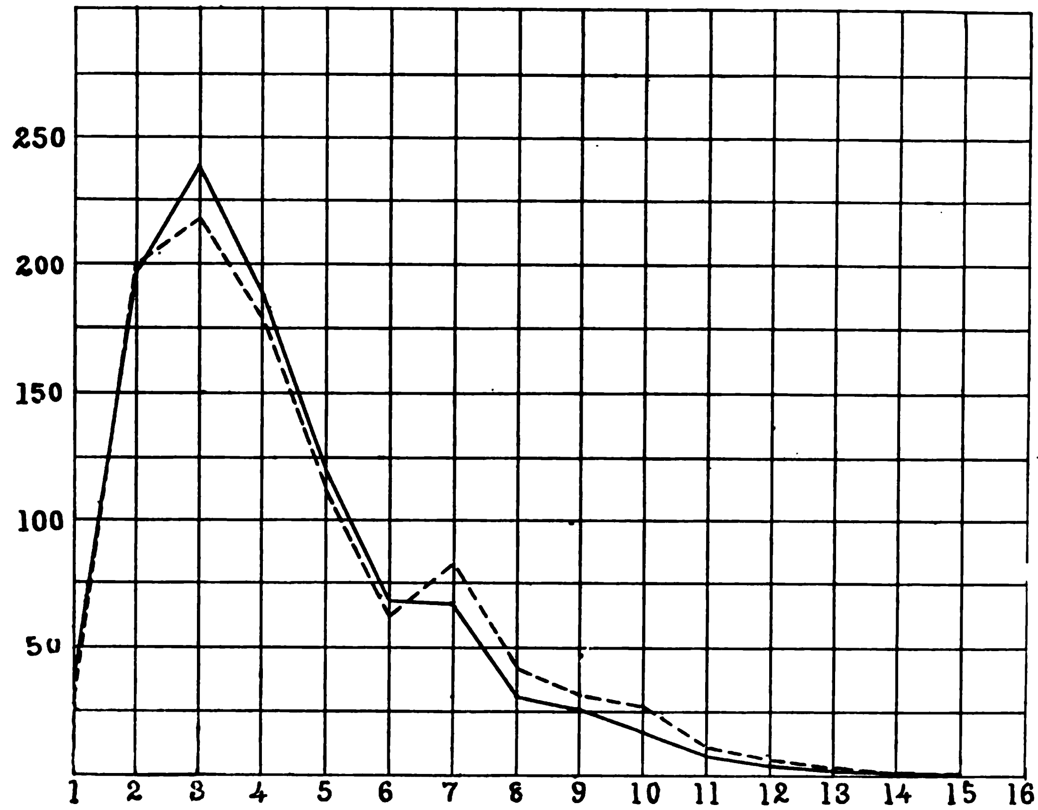



Fig. 10. — Two groups, of five thousand words each, from addresses of Edward Atkinson: Address to workingmen, ——; to alumni of theological seminary, — — — —.

## *TIDAL OBSERVATIONS OF THE GREELY EXPEDITION.*

The principal tidal observations were made at Fort Conger, on Lady Franklin Bay, by various members of the expeditionary force working under direction of Sergt. Edward Israel, and with a general supervision by the commanding officer of the expedition. They consisted of hourly heights of the tide from Aug. 20, 1881, to July 1, 1882, and the times and heights of high and low waters from Aug. 20, 1881, to June 30, 1883, both series read from fixed staff gauges and practically continuous. A broken series of high and low waters from July 1 to Aug. 8, 1883, obtained under unfavorable conditions, were not used in the discussion. There were also short series at seven outlying stations on the coasts of Greenland and

Grinnell Land, and a casual observation of high water at the head of Greely Fiord, during the progress of the readings at Fort Conger, with a dozen or more high and low waters noted during the retreat through Kennedy Channel and Kane Basin. The original records, too bulky for easy transportation, were left stored at Fort Conger when the party abandoned that station; but close transcripts, previously prepared and carefully verified, were brought away by Lieutenant Greely, and on his return to this country referred to the superintendent of the coast and geodetic survey, and later were placed in the hands of Mr. Alex. S. Christie, chief of the tidal division of the office, for reduction and discussion.

The weak point of tidal observations is almost invariably, even in middle latitudes, the instability of the staff and the undetermined fluctuations in altitude of the staff zero; so that it not infrequently happens that a satisfactory reduction of all the observations to the same plane of reference is a wholly intractable problem. In high latitudes, at stations beset with heavy ice, even short series are, as a rule, sadly out of joint and comparatively worthless. Unless the stability of the gauge is absolutely assured, which can seldom be the case, only frequent resort to levels between the gauge and one or more permanent bench-marks on shore can insure scientific value to the observations. At Fort Conger the observations of the first year depended in this respect upon a gauge that seems to have been stable, those of the second upon series of spirit-levels. Only two months of the series were in much doubt, and a tolerably satisfactory adjustment of these was finally effected. The observations bear abundant internal evidence of a conscientious and persistent endeavor to secure trustworthy and precise results; and, although they are far from equalling observations of standard excellence in middle latitudes, they are believed to constitute the longest and best series ever brought back from the arctic seas.

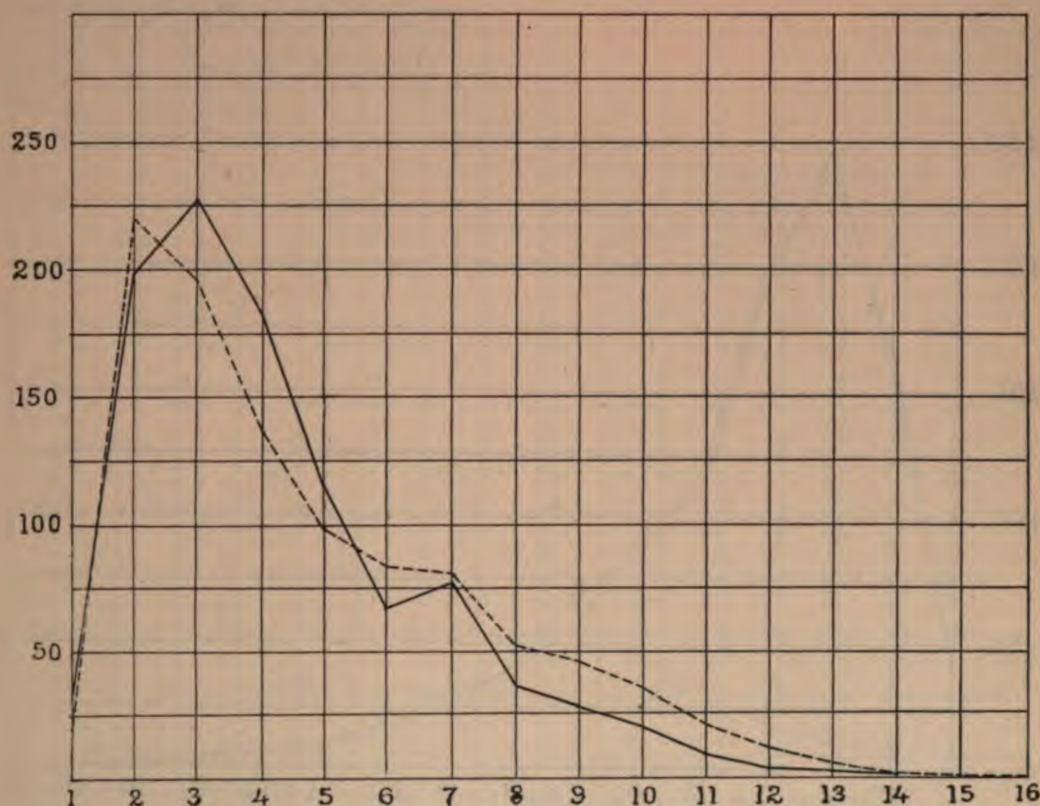



FIG. 17.—TWO GROUPS, OF TEN THOUSAND WORDS EACH. ATKINSON, ———; MILL, — — — —.

Following are some of the results of a non-harmonic analysis of the observations at Fort Conger:

the mean lunitidal intervals are $11^h\ 38^m.8$ and $17^h\ 45^m.8$; the mean range is 1.828 metres; the semi-mensual curves for intervals and heights give the age of the tide 1.4 days, the moon tide 2.2 times the sun tide, and satisfy closely the equilibrium formulae of Bernouilli. The diurnal inequality in height is, in comparison with the whole tide, three times as small as in Smith Sound; the influence of the sun in producing it is practically equal to that of the moon; it vanishes for high water $2^d\ 22^h$ after, for low water $1^d\ 08^h$ before, the vanishing of the moon's declination, and the interval of the two former events appears to be independent of the solar declination. A method of graphical analysis, due to the late Assistant L. F. Pourtales of the U.S. coast survey, brings out the fact that the diurnal inequality at Fort Conger is caused by a wave that has a sidereal day for its mean period; the same thing is also shown to obtain at Port Foulke and Van Rensselaer harbor in Smith Sound, and at Thank God harbor in Polaris Bay. The general phenomenon of diurnal inequality is then taken up as a problem in kinematics, the diurnal inequality wave is analyzed into its principal components, and the sidereal period shown to have place at still other stations both within and without the arctic circle, and to be a rule rather than an exception. The results of an harmonic analysis of the first year's observations will be found in the report: in so far as they relate to the same matters, they confirm the results previously found and stated above.

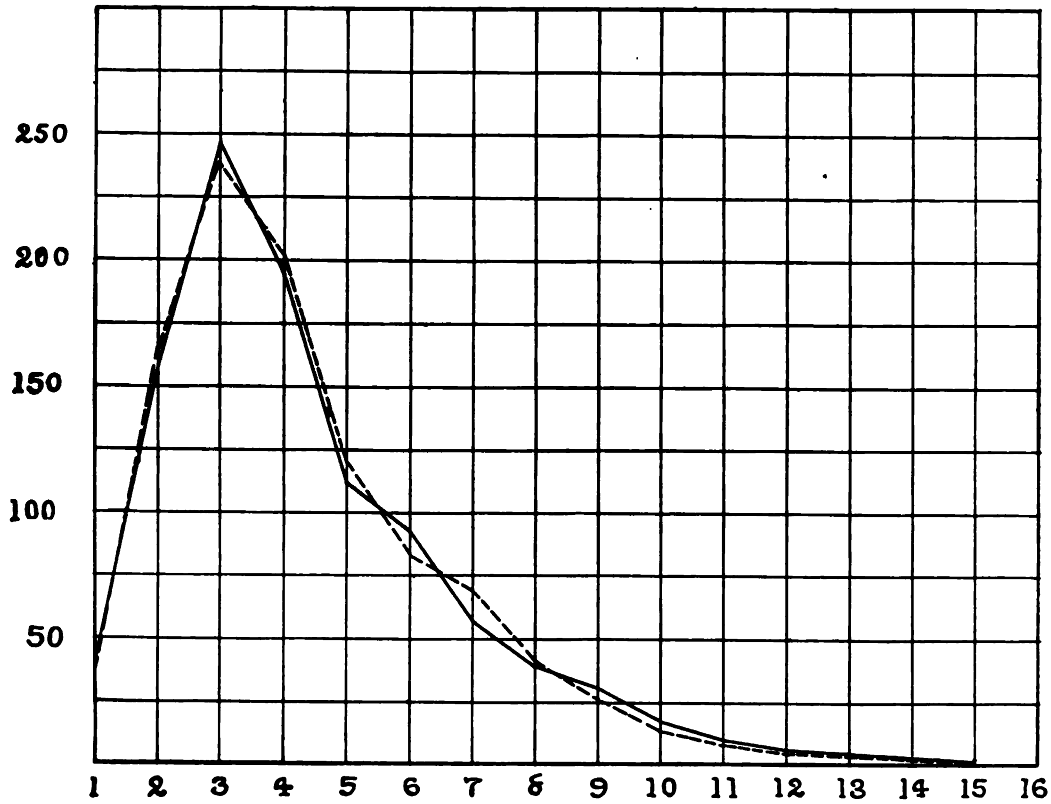



FIG. 12. — TWO GROUPS, OF TEN THOUSAND WORDS EACH, FROM DICKENS: 'OLIVER TWIST,' ———; 'CHRISTMAS CAROL,' — — — —.

A comparative study of the specific characters of the Fort Conger and other arctic tides with the cotidal lines, widths, and depths of the tidal avenues to the Polar Ocean, with whatever other tidal data from high latitudes was accessible, resulted in certain inferences stated in the report, and which may perhaps be tolerated here. The weakness of the tide-producing forces near the pole and a propensity to dissipate as a free wave as soon as formed, in waters of even moderate depth, are two causes operating to prevent the generation of local tides of appreciable magni-

tude in that region. The tides of the Pacific are not likely to make themselves felt in that vast expanse through a strait only some forty miles in width and less than thirty fathoms in depth, with far-stretching shoal approaches on either side. On the other hand, the relation of the Polar to the Atlantic Ocean is so intimate as to amount to identity. The continuity of the Atlantic basin has been demonstrated by soundings up to and beyond the 80th parallel. The channel between Spitzbergen and the European coast is about a hundred fathoms deep and four hundred miles in width; that between Spitzbergen and Greenland has about the same width, but is one, two, and three miles deep. The tides of the circumpolar seas cannot avoid forming a part of the Atlantic system. As to the tide in Lady Franklin Bay, it seems almost a certainty that it is chiefly an Atlantic tide that has flowed up through the Spitzbergen Sea, rounded Greenland, and entered Robeson Channel from the north, where it probably meets another and fainter Atlantic tide from the south, which, delayed and spent in the shallow West Greenland seas, comes into Lady Franklin Bay two or three hours later.

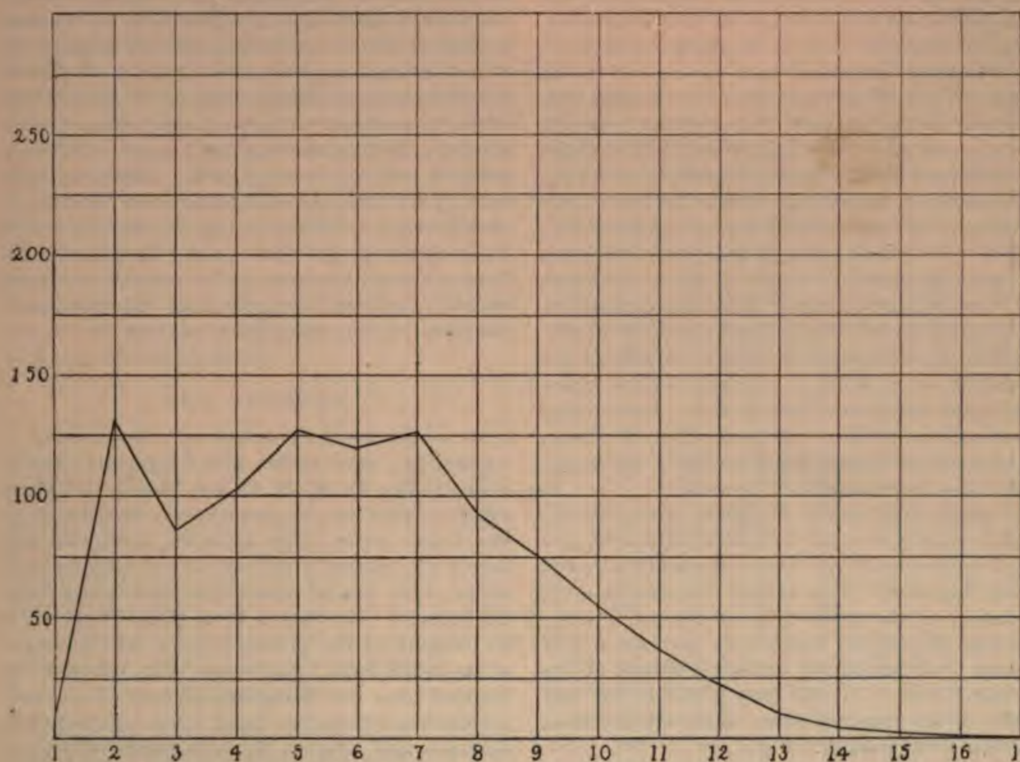



FIG. 13.—GROUP OF FIVE THOUSAND FIVE HUNDRED WORDS FROM CAESAR'S 'COMMENTARIES.'

But the laws of the tides in the circumpolar seas, a *cul de sac* into which run the tides of an ocean stretching from pole to pole, and where the absence of controlling astronomical forces is favorable to tidal anarchy, can only be determined with certainty from long series of observations at stations generously distributed about the polar basin. The establishment and maintenance by Lieutenant Greely of one such station, and his preservation of the records of observation, will be regarded as substantial services to science by all interested in this branch of physical inquiry.

A. S. C.

## AGRICULTURE IN ENGLAND IN 1886.

IN outlining, in a recent number of *Science* (ix. No. 212), the reports presented by the British commission on the existing trade depression, special attention was called to the fact that it was admitted on all hands that the agricultural classes were the worst sufferers. The lower prices of agricultural produce were very far-reaching in their consequences. For this reason the latest returns as to that produce are of timely interest; and we con-

dense them from a recent parliamentary paper which shows the extent of acreage, and the estimated average produce per acre, of the principal crops of the United Kingdom for 1886. The estimate is based on returns received from about 14,000 parishes.

The figures show that during the year, England produced a wheat-crop of 58,071,171 bushels, which shows the large falling-off of 15,950,077 bushels, or more than 21 per cent on the year 1885, at an estimated average in 1886 of 26.87 bushels an acre, against 31.51 bushels in the year before. The falling-off from the average yield of an acre appears in all the counties of England except four. For Wales the estimated total produce of wheat amounted to 1,501,075 bushels, at an average rate of 21.86 bushels an acre, being .33 of a bushel above the estimated normal average. For Scotland the total produce of wheat is shown to be 1,895,-652 bushels, at an average rate of 33.77 an acre, which may be compared with an average of 34.33 in 1885. The year's average, though smaller than the previous year's, is larger by nearly a bushel than the ordinary average. The aggregate results for wheat in Great Britain thus amount to 61,467,-898 bushels, as compared with 77,587,666 in the preceding year, while the acreage under wheat was 7.8 per cent below that of 1885. Ireland also shows a diminution in the production of wheat, the numbers of bushels being 1,879,987 as against 2,048,103, a decrease of 8.21 per cent.

Of barley, the United Kingdom produced 78,-309,607 bushels, as against 85,721,632 in 1885, and this decrease of 8.65 per cent is shared by all parts of the kingdom. The return for oats is more favorable, as the production of the whole kingdom was 169,376,088 bushels, an increase of 5.57 per cent over 160,440,907 bushels, the yield of the preceding year. In this crop Wales is the only portion of the kingdom where there is a decrease, and that is very small.

The pulse-crops are again a partial failure in many counties, and the production of beans and peas shows unsatisfactory results when compared with the normal rate of yield. The numbers for the whole kingdom, however, show an advance on those of 1885, being, for beans, 10,307,187 bushels, an increase of 15 per cent; for peas, 5,855,382, an increase of 35 per cent.

Of the root-crops, potatoes show a decrease from 6,374,242 tons to 5,835,487, a falling-off of 8.45 per cent; and of this, Ireland bears more than her share, as the returns from that country fell off 16 per cent. Wales and Scotland, on the other hand, are a little above the average. Turnips show an improvement in all the four divisions of the kingdom, having risen from 24,062,-608 tons to 33,957,415, which means an increase of over 41 per cent. Mangold, again, shows nearly as large an increase, from 5,969,523 tons to 7,788,-811 tons, which is over 30 per cent.

The hay-crop from grass grown on permanent pasture-land is shown to exceed slightly the average yield an acre in Great Britain, the total produce amounting to 5,763,235 tons, while that from clover is at the normal average of 3,311,449 tons, the total produce of both descriptions thus showing an aggregate of 9,074,684 tons. Hops show a decided gain in the year, as the yield in 1886 was 776,144 hundredweight as against 509,170 hundredweight in 1885, or an increase of over 52 per cent.

The tables show, that, on comparing the figures for 1886 in Great Britain relating to the produce of the crops dealt with, mangold, hops, and hay are the only ones showing an increase on the estimated ordinary average yield. Corn and pulse crops, potatoes, and turnips all show a decrease on the average, though in some cases they are in advance of the previous year. The returns for Ireland show a decrease, on the average, of wheat, barley, beans, and potatoes, and an increase of oats, peas, turnips, mangold, and hay.

## NATURAL GAS.

IN a paper on the pressure and composition of natural gas, read before the Engineers' club of Philadelphia, Dr. H. M. Chance stated that there are no records of the gas-pressure first shown by the larger wells The recorded pressures were nearly all observed after the gas had been blowing off for some weeks, months, or even years; and the pressure then shown by a gauge is evidently no measure of the pressure under which the gas exists in the rock, for the gas soon becomes exhausted from the immediate vicinity of the well, which then draws its supply from a considerable distance, and perhaps through bands of rock of such texture — and perhaps even through the clay filling of crevices — that the pressure shown at the well may be only a fraction of the actual pressure.

Hence, while recorded pressures range from about 600 down to 200 pounds per square inch, there is every reason to believe that the actual pressures are perhaps from 500 to 1,000 pounds per square inch, or even in some cases much greater, but still being less than the maximum as limited by depth. This maximum is very much less than the pressure necessary to effect liquefaction, and the supposition that the gas exists as a liquid must therefore be abandoned.

One of the most interesting phenomena recently observed in natural gas is its variability. The analyses of Professor Sadtler, made some nine years

ago, showed that gas from wells located in districts not connected with each other was similar in composition, but that the percentages of the different gases present varied widely; and more recent analyses show that gas from wells in the same 'pool,' and even that from the same well, is subject to daily and even hourly variations in composition. When it was found that the calorific value of the fuel was subject to change from time to time, as shown by variations in temperature of the furnaces, and in the steam-pressure of boilers under which it was burnt, this was at first supposed to be due to differences in pressure; that is, in the quantity of gas delivered to the burners in the fire-box. Automatic pressure regulators were introduced, and the producing companies perfected a system by which the pressures were maintained at a nearly constant figure, yet the same variations were observed. The chemists then began to examine the gas, and soon found that it was extremely variable in composition. The following table shows the results of ten analyses of natural gas, the first four being made from gas taken from the same well at different times, and the others from the gas of different wells in different districts: —

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbonic acid ($CO_2$) | .80 | .60 | – | .40 | .34 | .35 | .66 | 2.28 | – | .30 |
| Carbonic oxide ($CO$) | 1.00 | .80 | .58 | .40 | trace | .26 | trace | – | 1.00 | .60 |
| Hydrogen ($H$) | 20.02 | 26.16 | 29.03 | 35.92 | 6.10 | 4.79 | 13.50 | 22.50 | 9.64 | 14.45 |
| Marsh gas ($CH_4$) | 72.18 | 65.25 | 60.70 | 49.58 | 75.44 | 89.65 | 80.11 | 60.37 | 57.85 | 75.16 |
| Ethane ($C_2H_6$) | 3.60 | 5.50 | 7.92 | 12.30 | 18.12 | 4.39 | 5.72 | 6.80 | 5.20 | 4.80 |
| Propane ($C_3H_8$) | – | – | – | – | trace | trace | – | – | – | – |
| Nitrogen ($N$) | – | – | – | – | – | – | – | 7.32 | 23.41 | 2.89 |
| Oxygen ($O$) | 1.10 | .80 | .78 | .80 | – | – | – | .83 | 2.10 | 1.20 |
| Illuminating hydrocarbons | .70 | .80 | .98 | .60 | – | .56 | – | – | .80 | .60 |
| Ratio, C to H (weight) | 2.72 | 2.59 | 2.64 | 2.59 | 3.08 | 3.00 | 2.88 | 2.70 | 2.91 | 2.84 |

## *SUPAN'S JOURNAL OF COMMERCIAL GEOGRAPHY.*

THE latest supplement of *Petermann's Mittheilungen* forms the first number of a journal of commercial geography. Prof. A. Supan, the able editor of the *Mittheilungen*, intends to give in the new periodical at regular intervals a report on the agricultural and industrial produce and of the commerce of all continents successively. The present number contains a brief introduction and the report on America. The principal feature of the new journal is the use of the results obtained by statistical observations for geographical purposes. German geographers of late apply much of their time and work to studying the mutual relation between geographical phenomena and the history of mankind. We call to mind Ratzel's 'Anthropogeographie,' which gave rise to numerous discussions, and was an incentive to many researches of a similar kind. The new periodical belongs to this class of publications. Supan sets forth his plan in the introduction. He intends to give a collection of reliable data arranged from geographical points of view. Thus he hopes to give material that will be useful by its clearness, and will enable the student to investigate the history of commercial life. "Whoever intends to study the relation between man and nature," he says, "must not confine his researches to a brief period. I am convinced that the geography of civilization must be studied from an historical stand-point. Here is the place where geography and history will meet again; this is the way in which geography may become a practical science in the noblest sense of the word."

Supan arranges the statistical data contained in the report of the tenth census of the United States into four principal groups, and proves that the north-eastern states have largely an industrial population. In the central group industrial and agricultural population are almost of equal importance, while in the southern the agricultural one predominates. In the western states the influence of the mineral resources is characteristic. Supan's discussion of the agriculture of North America is accompanied by several maps which give a clear idea of the distribution of cultivated land and of the culture of wheat cotton, and tobacco. The tables are so arranged as to show the moving of the principal district of production from east to west which began between the years 1850 and 1860. In 1850 the maximum of production was found in the southern Atlantic states; in 1860 it had moved to the Mississippi-Ohio group. At the same time the minimum moved from the prairie states to the plateaus. The agriculture of the whole east shows a permanent decrease, the northern-central and the western states a permanent increase of their relative importance, while the southern states have remained stationary. The rapid increase of the importance of agriculture which prevailed in the Mississippi and Ohio group during the last thirty years has ceased,

*Archiv für Wirthschaftsgeographie. I. Nordamerika.* Ergänzungsheft No. 84 zu *Petermann's Mittheilungen.* By A. SUPAN. Gotha, Justus Perthes.

and in their stead the prairie states are rapidly developing.

We point out only a few of the important results Supan obtained by the geographical arrangement of statistical data and of his critical remarks on the available material. In studying the industry and agriculture of the United States, he again divides them into four groups, — the north-eastern industrial district, the southern and central agricultural district, the mining district of the western plateaus, and the Pacific district, in which agriculture prevails while mining and industry are of considerable importance. The character of the United States is still that of an agricultural country, but industry is growing rapidly upon agriculture. As compared to these, mining is insignificant, the whole mineral production being only eighteen per cent of the agricultural. As we approach the southern states, the industry decreases, while agriculture increases. Going west, industry decreases, and is a minimum in the prairie states; farther west its importance is again increasing. The north-eastern states have changed their character from that of agricultural states to industrial ones. The industry of the United States is founded upon the produce of agriculture, and every province works up its native material, — the southern states, cotton; the southern-central states, tobacco, iron, etc. The New England states form the only exception. Cotton, wool, and leather manufacture are the predominating industries, — though cotton does not grow there, — and stock-raising is of no importance. The industry of this region has the same character as that of England. It consumes for manufacture the produce of foreign countries. A map accompanying the report illustrates the distribution of industrial production in North America.

The data on the commerce of the United States do not refer to 1880, as those on production do, but are the mean of the five years 1880–84. Supan prefers this method on account of the irregular fluctuations, which are of greater importance in commerce than in production. He arranges the commerce of the seaports so as to show that those of the northern Atlantic coast are importing while the southern ones are exporting. In the interior the lake district as far as Cleveland is importing; farther west it is exporting. On the Pacific coast the northern ports are exporting, the southern ones are importing, while in San Francisco both branches are of equal value. The export of manufactures is steadily increasing in value as compared to that of agricultural produce.

The statistical data on Canada show that the proportion of the industrial and agricultural population is about the same as in the United States. The principal difference is, that the proportion is evenly distributed in all parts of Canada, while very wide differences exist throughout the United States. Canada is now in a stage the United States passed through before the rapid development of the western states and territories. The western provinces of Canada are not yet as far developed as those of the United States, and the shifting of production to the prairies, which has been going on here for more than thirty years, has scarcely begun there.

The present volume shows that results of eminent practical value may be obtained by the application of geographical methods to sociological problems. It opens new points of view to the student of political economy, showing the close connection between man and the country he inhabits.

F. BOAS.

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STARTING from the common observation that when we do hard thinking we cannot at the same time use our muscles actively, Dr. J. Loeb (*Pflüger's Archiv f. Physiologie*) has attempted to estimate quantitatively the relation between physical and psychical activity. His method was to record his maximum grip on a dynamometer; then, after a short rest, to begin some mental work; and, while engaged in this, to record the maximum grip once more. The result was, that the latter grip was decidedly less powerful, and that the difference between it and the former grip was the greater, the more difficult and absorbing the mental process. For instance: in one case the normal grip with the left hand depressed the lever of the dynamometer to 77°; while reading and *understanding* (i.e., he could repeat the substance of it in his own words) a scientific work, only to 15°; while simply reading it as so many sounds, 67°. Another gentleman (Professor Zuntz) could normally depress the lever to 69°; but, while reading a catalogue of names (requiring little mental strain), to 53°. Dr. Loeb's average maximum grip when not occupied with mental work was (mean of both hands) a depression of the lever to 85°; while multiplying one number under 10 by another such number, the depression was 81°; when the two numbers were between 10 and 20, only 35°; when between 20 and 30, only 14°. This shows very clearly how the energy given over to the mental exertion is taken off from the muscular effort. It must, of course, be understood that these results have only a general value. The method presents many mechanical difficulties; the question of attention is an important factor; and Dr. Loeb simply offers these results as a preliminary statement of his intention to work upon this problem.

# SCIENCE.

FRIDAY, MARCH 18, 1887.

## *COMMENT AND CRITICISM.*

THE SIXTH CONGRESS of the Société nationale des professeurs de Français en Angleterre, held at London in January, attracted considerable attention from educators generally, and principally, it seems, from the very instructive address with which Dr. Jowett welcomed the members of the congress to Oxford for one of their sessions. The honored professor of Greek at Balliol assured the visitors that the ancient and modern languages have no quarrel, but rather they are related as parents and children, and the greatest affection should exist between them. In particular, he continued, no Englishman can be indifferent to the excellence of Bossuet and Fénelon, Montesquieu and Turgot, Voltaire and Rousseau, Montaigne and Pascal, or insensible of the great debt owed to these men by the English language and literature. It must be remembered, too, that above all other European languages, in French had been developed the noble and enviable quality of lucidity of style. Dr. Jowett then confessed that the treating of the modern languages in England was capable of great improvement. The first step in this improvement must be the following of a natural method. What this is, Dr. Jowett immediately specified: "Nature teaches us to begin with the ear, and not with the eye; with association, and not with analysis; with imitation, not with abstractions; with conversation, not with books of exercises. The powers of the mind generally strengthen, at least to middle life; but the faculty of learning languages decays, and is almost in inverse ratio to one's years. It is stronger before than after ten, stronger at twenty than at thirty, and so on." Furthermore, nature teaches us that a task should be proportioned to the capacity of the learner; and therefore instruction in the modern languages, which are the easier, should precede that in the classics. The speaker also commented severely on the too great time now spent in acquiring a very moderate knowledge of the classics, and called for a 'reform of procedure.'

No. 215 — 1887.

Sufficient emphasis, continued Dr. Jowett, is not laid upon an acquaintance with modern languages. The universities still guide to a very large extent the education of the country, and they have heretofore given slight encouragement to the study of French and German. While the universities neglect these studies, they will be neglected at the schools and undervalued in the homes. He then made a suggestion which we have supported on several occasions already; namely, that a reasonable knowledge of some modern language may fairly be demanded of every university student, but — and here we must differ even from so distinguished an educator as the master of Balliol — for his degree, not for admission. We are not so sure that it is altogether fair to say that no one but a native can impart "the accent, the intonation, the true living voice of a language." Dr. Jowett said this, and of course his guests did not disagree with him. But it seems to us to go too far. Under this dictum, Max Müller would be prohibited from teaching English, and Mr. Saintsbury from teaching French. Before concluding their session, the French masters passed a formal resolution, asking for the establishment at Oxford of a school of modern languages, in order to encourage the study of French literature, and of the French language as a living tongue.

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FOR THE BENEFIT of those who are fond of impressing on us continually the great advantages to be gained from a thorough and detailed system of methods, we would call attention to the book of instructions which has lately been issued in Austria, for the use of the teachers in the realschulen. The French system has always been supposed to be the most highly organized possible, but Austria is a dangerous competitor for the honor. It is Mr. Matthew Arnold, it will be remembered, who tells the story of the French minister of education who pulled out his watch and exclaimed that at that instant all the children of France were receiving instruction on the same subject. The same thing may hereafter occur in Austria; for, as the Vienna correspondent of an English journal remarks, "the Austrian teacher who, in his geog-

raphy-lessons, is treating the Caucasus, will no doubt be cheered by the reflection that at the same moment all the geography-teachers in the empire are treating the Caucasus, and, like himself, are calling attention to the points of similarity between the Caucasus and the Pyrenees, the straightness of the two mountain-ridges, the low plain to the north of each, the small number of passes in each, and the reach of both from sea to sea." For all this is laid down in the big book of instructions. Moreover, the teacher's expression of countenance must be professional, and not the index of his feelings; for the regulations expressly provide that "a teacher, on crossing the threshold of the school, must exhibit a cheerful and contented countenance, to show that he has his work at heart." We cannot imagine any thing much more nonsensical or degrading to the teaching profession than this. We believe, as much as any sensible educator does, in organization and method; but, when it is allowed to proceed to such lengths as the above instances indicate, it is high time to call a halt. Method gone mad is worse than no method at all.

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PROF. WILLIAM JAMES is certainly the pleasantest and clearest writer we have in this country on psychological topics. His short articles, while never difficult reading, are always worth reading, both from the popular and the scientific standpoint. His latest paper, on 'What is an instinct?' in *Scribner's magazine*, is an excellent example of this. In style and form it closely resembles the same writer's recent paper on habits, to which we called attention at the time of its publication. In each a psychological study is concluded by a pedagogical rule of practice. As in the previous paper Professor James pointed ou the importance to the teacher of a knowledge of the psychology of habits, so here he says that "to detect the moment of the instinctive readiness for the subject is, then, the first duty of every educator. As for the pupils, it would probably lead to a more earnest temper on the part of college students if they had less belief in their unlimited future intellectual potentialities, and could be brought to realize that whatever physics and political economy and philosophy they are now acquiring, are, for better or worse, the physics and political economy and philosophy that will have to serve them to the end." Professor James accepts the definition that instinct is the faculty of acting in such a way as to produce certain ends, without foresight of the ends, and without previous education in the performance. This is slightly less specific than Mr. Romanes' definition. which is, that instinct is a generic term, comprising all those faculties of mind which are concerned in conscious and adaptive action, antecedent to individual experience, without necessary knowledge of the relation between means employed and end attained, but similarly performed under similar and frequently recurring circumstances by all the individuals of the same species.

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Professor James prefers to subsume instinctive under reflex actions, though we think Prof. Lloyd Morgan's criticism on so doing deserves consideration. Professor Morgan, with Mr. Romanes, defines reflex action as non-mental, neuro-muscular adjustment, due to the inherited mechanism of the nervous system, which is formed to respond to particular and oft-recurring stimuli, by giving rise to particular movements of an adaptive but not of an intentional kind. He then asks whether it will not be better to avoid introducing the term 'reflex action' into the definition of instinct, inasmuch as a reflex action is a direct response to a definite stimulus, and puts the specific question, Can we call all instincts, for example the migratory instincts of birds, reflex actions? Professor James sees clearly that the answer to such a question as this must rest upon the extension permitted to the term 'instinct,' and he himself confines instinct to impulses to act resulting from present sensations. The writer also makes good use of Schneider's 'Der thierische Wille,' but is specially happy in his demonstration of the way in which two scientific principles — the inhibition of instincts by habits and the transitoriness of instincts — account for what Mr. Romanes has called 'derangements of the mental constitution.' The paper is a most excellent combination of the scientific and the popular, and we heartily commend it to all intelligent readers.

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IN THE LONDON *Journal of education* for February, the Rev. R. H. Quick has an article on 'Dr. Paulsen and the curriculum of the future,' which contains the surprising statement that the writer — and Dr. Quick is one of England's best informed educators and educational writers — had not seen or heard any mention in England of Dr. Paulsen's 'History of the higher instruction in Germany.' He then proceeds to paraphrase the major portion

of Dr. Paulsen's concluding chapter, and to apply its sentiments to the discussion as to the nature of the curriculum of the future. We are several thousand miles farther from Berlin than our English co-workers, yet Dr. Paulsen's name and thought are well known here. In fact, the *Academy* published recently, in the form of a supplement, a complete and very excellent translation of Dr. Paulsen's now celebrated final chapter. We cannot understand the English ignorance of Paulsen's work and status, unless that people fails to read all educational literature published off the Island of Albion, which is an opinion we shall be very sorry to hold. Professor Paulsen is one of the most popular professors in the Berlin faculty, and he lectures to large audiences of students. He is also a councillor of state for education and one of the state board of examiners of the candidates for licenses to teach, and has in a variety of ways exercised a wide influence on Prussian education. His philosophical writings are of a very high order, and he is surpassed by no one in his critical mastery of the history and philosophy of education.

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THE DOUBLE NUMBER of the *Library journal*, bearing the date January and February, will be very valuable for future reference because of the tables it contains concerning the libraries of the United States. The statistics are taken in the first instance from advance sheets of the forthcoming report of the bureau of education, and an addition is made of the names of the librarians and a classification of the libraries according to size. The government list comprises all libraries having 300 volumes or over, and contains 5,338. The *Library journal*, however, only reprints the information concerning those of 1,000 volumes or over, and these number 2,981. Forty-seven of these have over 50,000 volumes; and among the forty-seven are the public libraries of Boston, Chicago, and Cincinnati, and the libraries of Harvard, Columbia, Yale, Cornell, and Brown universities. These forty-seven libraries aggregate 5,026,472 volumes; and the whole list of 5,338 libraries aggregates 20,622,076 volumes, or one volume to every three persons in the country. In round numbers, the United States has one library to every ten thousand of population, though in many states the proportion is far greater. New Hampshire, for example, has a library to every 2,700 persons. The neighboring states of Massachusetts and Connecticut furnish a library to every 3,134 and 3,479 persons respectively. California, Colorado, Wyoming, and Michigan stand well up on the list. The southern states, as might be expected, make the worst showing, Arkansas bringing up the rear with one library to every 50,158 of population.

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A TENDENCY is observable on the part of many young teachers, whose enthusiasm and imagination are roused by the great discoveries of modern science, to substitute in their instruction the method of discovery for the method of exposition. Excepting for advanced students, in university courses and the like, the substitution is rather confusing than beneficial. The young child cannot rise to an appreciation of the relations between isolated facts save as these are used in illustration of a principle. There must be some support on which to hang the facts in question, if the child is to grasp their significance. For this reason we believe that there is a stage in education when it is preferable to state a simple principle, and then illustrate it fully, than to present the pupil with a congeries of facts with the request that he ascertain their relations and causal dependence. Yet a great many young and well-instructed — save in pedagogics — teachers, understanding themselves the value and purposes of the method of investigation, demand of their pupils what the latter are not able to give. The fact should be recognized that the method of exposition has a determined place in education, and should be awarded it.

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DR. LUCY M. HALL, physician to Vassar college, in a short paper in the *Popular science monthly*, brings to the discussion concerning the higher education of women inaugurated by Dr. Withers-Moore — to which we have alluded several times already — some conclusions deduced from statistics gathered by herself concerning the number of children born to women who have pursued a course of higher education. The statistics were gathered for the purpose of measuring the great falling-off in numbers in the American family, and, though by no means complete, they bear directly upon the question at issue. The data were taken from all grades of American life save that found in extreme poverty. The women were, as a rule, simply educated. A few were more highly educated, and the figures show that the largest families of the present generation belong to the

most highly educated of the women. One hundred and seventy-five families give an average of 3.2 children to each. Of the few really large families, the evidence shows the mothers to have been in most cases well educated, and in a few cases exceptionally so. Dr. Hall's own experience has been, that young women in college are unusually healthy, and become increasingly so as the course progresses. She quotes President Bascom, of the University of Wisconsin, as saying, "The young women do not seem to deteriorate with us in health, but quite the opposite. . . . It has long seemed to me plain that a young woman who withdraws herself from society and gives herself judiciously to a college course is far better circumstanced in reference to health than the great majority of her sex."

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## *GENERAL PSYCHOLOGY, ITS DEFINITION, LIMITS, AND METHOD.*[1]

### I.

It is necessary at the commencement of this treatise, not to define, — for that is almost impossible, — but to explain, the meaning of the term 'general psychology.' In fact, until now the term has been very rarely used; and in all scientific literature there is no work, so far as our knowledge extends, that bears this title.

Psychology, as ordinarily understood, is the science of intelligence: thus all depends upon the extension given to the word 'intelligence.' Taken etymologically only, intelligence signifies the comprehension of things, or the knowledge of the causes of action; but taken thus, the term is too narrow, for it follows that there is no intelligence save in connection with a self-conscious being. An unconscious intelligence would be, viewed etymologically, a meaningless phrase, since to comprehend a thing would imply, by definition, the consciousness of the comprehension. But the instances of unconscious intelligence, absurd though the expression is, are certainly many and convincing. Take, for example, the ordinary occurrence of the solution of a problem during sleep, though he who solves the problem is in total ignorance of it. Can it be denied that an intellectual process is here involved? We must, then, admit that there are intellectual phenomena which are unconscious or nearly so; and therefore psychology cannot be limited to the study of self-conscious intelligences. The chief difficulty here is in the language, since no other term except the inaccurate one, 'intelligence,' can be applied to this unconscious mental activity. The expression 'psychical activity' is indeed better, though somewhat pedantic. Perhaps it would be more fitting to use the word 'ideation,' leaving to the term 'intelligence' its precise, clear, and evident meaning; namely, the conscious comprehension of things. I, for my part, prefer to give the term 'psychology' an application wider even than unconscious ideation and conscious intelligence: for there are numerous beings which perform complicated acts that are called instinctive, in which no intelligence, whether conscious or unconscious, is involved. Can it be said that psychology takes no notice of instinct? Surely its exclusion would be permitted by no one. Instinct is a psychic force, intelligent as to the end in view, if not as to the means employed. This is sufficient to give it a place in general psychology.

Even if the act performed is not understood by the agent, it is nevertheless perfectly adapted to its end. Thus a vague and latent intelligence, of which we cannot deny the existence, is manifested. Moreover, we can trace all the gradations, in a clearly defined hierarchy, from blind instinct to wholly conscious intelligence. There are, then, diverse psychic forces, — instinct or latent intelligence; ideation or unconscious intelligence; and, finally, intelligence properly so called, that is, conscious intelligence.

But what are the sources of instinct? Whence does it arise? We do not fear to go on to such consequences as general psychology may point out. Just as the zoölogists and embryologists assign to beings, however diverse, the humble origin of a primary cell, so we may trace all psychic forces, instinctive and intelligent, to their humble origin in an elementary reflex action. Instinct is not always so complicated, as it is usual to suppose, when the term is employed without qualification. Unquestionably the instinct of the mother who bends lovingly over the cradle of her child, that of the bee that builds its hexagonal cell, and that of the insect which poisons the body of its victim behind the second cephalic ring, constitute complex intellectual operations, of which the psychological character is undeniable. But how often is instinct more simple and rudimentary?

Let us take an instance which is of historic interest; for it was by this example that Descartes first gave us, with remarkable precision, the theory of reflex action. Here is a heated object: if the hand touch it, it is immediately withdrawn. Is this instinct, is it reflex action, or is it an act of intelligence? Here is an act which at the same time combines the characteristics of all three classes of phenomena. It is an act of intelligence,

[1] Translated for this journal from the author's forthcoming work, entitled 'Essai de psychologie générale.'

because consciousness, and consequently will, are involved; it is instinctive, because it is an instinct necessary to the preservation of life, and common to all beings, to avoid a contact which gives rise to pain; finally, it is reflex, for it is not determined by the will, and the withdrawal of the hand is effected before the resolve to withdraw it is made. Here, then, is an elementary reflex act which is at the same time intelligent and instinctive. Among the lower animals many instinctive movements are nothing but reflex actions. A limpet clings to its rock: it is but slightly fastened, and moves but slowly over the surface of the stone. But touch its shell, and attempt to lift it, and instantly it fastens itself firmly to the rock; and to detach it a very great expenditure of effort is necessary. Its firm adhesion to the stone has been instinctive, suddenly and resistlessly determined by contact with the aggressor. It *is* a reflex action, but instinct is also involved.

It is truly impossible to say just where instinct begins and reflex action ends. The two phenomena intermingle, and instinct should be regarded as a complicated reflex action.

'Intelligence,' 'instinct,' 'reflex action,' — these are the three terms of psychology. Between these three forms of activity there is no barrier, no hiatus, no abyss. The gradation is regular and without leap. And why should it not be so? Where in nature can sudden transitions, the existence of which was denied even by Aristotle, be found? Sudden appearances of a new phenomenon are not known. Between the man and the animal there is hardly any distinction. There is hardly any between the animal and the plant, and the beginnings of psychology are in the beginnings of life itself. It would be a useless task to attempt to limit psychology to the phenomena of instinct or of intelligence. Psychology commences with reflex action; so that its domain includes elementary reflex action, the movement by which the limpet clings closer to the rock, as well as the most complicated intellectual operation, for instance, the discussion of the Abelian functions. In what follows we shall see how, by successive steps, psychical action frees itself little by little from the elementary reflex phenomenon. Our aim has been to take the psychic phenomenon at its origin, however humble that may be, and to follow it in its progress through the uninterrupted series of living beings.

II.

It is this synthetic treatment that seems to us to merit the title of 'general psychology.'

The term is rarely used; but we believe that it deserves to take its place among the sciences. We speak of general physiology, and the term is perfectly definite. The same should be true of general psychology. Chemistry is the science that treats of the molecular transformation of matter. According to the stand-point that is taken, we have a chemistry without any particular designation, treating of all the divisions of chemistry, or we have mineral chemistry, organic chemistry, physiological chemistry, industrial chemistry, analytical chemistry. But there is also a general chemistry, which passes over in silence both the particular facts, the details of which are without number, as well as their applications and the technique built upon them, while only the general laws of chemistry are discussed. The special subject of general chemistry is the totality of the molecular transformations of matter, — the theory of atoms, their affinities and classifications, the equivalence of forces, and so forth. Physiology, or the science of life, can also be studied from diverse points of view. We have physiology without any particular designation, which comprehends all the subdivisions of the science; human physiology, which studies specially the vital phenomena of man and the higher animals; comparative physiology, which treats of the vital functions of all animals in comparing the life of all beings from the lowest of animal forms to man, which is the highest development; vegetable physiology, which treats of the vital functions of plants; pathological physiology, which has to do with the functions of life as modified by disease; and, finally, general physiology, of which life in general forms the subject-matter. Details are passed over in silence, for they are due to special conditions which are almost invariably peculiar to some group of animals or other.

Such is the *raison d'être* of general physiology. It is the synthesis of all physiology, but of physiology apart from the myriad of details which encumber it, and set forth only in its main outlines and in its most general laws. While the classic works of physiology develop the complexity, which is almost infinite, of the vital function, general physiology presents us the picture of the grand unity of life as it is manifested, under forms so extremely diverse, on the surface of the earth.

Psychology, like physiology, falls into several very distinct divisions. There is a psychology without designation, which treats of psychology in its entirety and under all its phases; also a human psychology, limited to the study of the intelligence of man; also a comparative psychology, by which are analyzed the phenomena of intelligence exhibited by animals and allied to those manifested by man himself; a pathological

psychology, which describes and explains the modifications of the human intelligence caused by disease; and, finally, a general psychology, which, without taking up all the details of its subject-matter with their analyses and comparisons, strives to bring to a focus the facts of which the details are numberless. In a word, general psychology attempts to form a synthesis, profiting by the analyses made by human and comparative psychology.

For general psychology, as for general physiology, but one method is possible, — the experimental. And as to this, a short explanation is essential, in order that a confusion too frequently made may be avoided. As a matter of fact, an opinion, very easy of refutation, is frequently attributed to the defenders of experimental psychology. They are said to admit nothing but experience, and to deny the validity of introspection or the internal sense. But, on the contrary, no physiologist has ever thought of setting aside the subjective observation of the elements of knowledge. How can we study the effects of memory or of imagination, unless we observe ourselves? Who is the physiologist or naturalist that upholds this opinion? and why combat it, when no one defends it? Internal observation gives us a psychology based on experience which is quite as legitimate and quite as fruitful as the most thoroughly experimental physiology can be imagined to be. The facts gained from the study of the *ego* are quite as valuable, provided they have been observed carefully and methodically, as the physiological phenomena recorded in the laboratories by the most perfect methods that our modern technique has devised.

But, however important this internal observation may be when it addresses itself to consciousness, it can be applied to but a single object, the knowledge of the *ego*. Beyond this it is dangerous and sterile. In is not internal observation which tells us how the stars move, and what the properties of matter may be. It knows and studies the *ego*. It observes itself, it judges itself, but it is forbidden to leave this domain of the *ego*, — a domain so vast that numberless discoveries are yet to be made in it, and yet so narrow that the *ego*'s unsatisfied curiosity urges it eagerly beyond it. But here science alone, with its rigorous methods, its accurate apparatus, and its exact measurements, can make a progress which is slow but sure. In a word, introspection can only hope to know the facts of consciousness. The general properties of organic matter, whether it be inert or endowed with thought, remain for it unknown. They fall within the province of physics, chemistry, and physiology. Introspection can only judge phenomena.

But this is common to all the sciences. Nevertheless it applies particularly to psychology, which proceeds by introspection carried on with great care. For psychology cannot experiment: it can only observe. And it is well known that sciences founded upon observation are not so rich as are sciences of experiment, in conclusions of various and far-reaching import. Under all circumstances we are forbidden to ratiocinate, that is to say, to construct systems of metaphysics and of transcendental physics. That which psychology can do, and which it alone can do, is to observe the phenomena of consciousness. Beyond that, it is but an illusion.

Thus general psychology, aided now by introspection, now by the study of organic beings, now by experiment, extends from the lowest animal all the way up to man. But is this its whole sphere? For our part, we do not hesitate to say yes; for, if there should exist in nature intelligences or conscious powers analogous to those of man, they have not yet been revealed to us. Assuredly it would be absurd to suppose that this earth alone, among all the infinity of worlds, is the only portion of space where intelligent beings exist. The very fact that men exist on the earth renders it extremely probable that life has appeared on other stars also, and that there exist there intelligences similar to ours. The chemical composition of the stars is almost the same as that of our planet, and consequently the same phenomena ought to be manifest there as here. But our feeble science cannot go so far. We are limited to a terrestrial psychology, which is probably the only one of which man can ever know any thing. Though thus restricted to the animal world and to the consciousness of the *ego*, general psychology, presenting facts in their totality and not in detail, is not only a science of immense scope, but the most attractive of all the departments of human knowledge. CHARLES RICHET.

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## *GEOGRAPHICAL NOTES.*

### *Europe.*

Some more detailed news of the Riviera earthquake of Feb. 23 has been received. The facts, so far as they are of scientific interest, are summed up by Father Denza of the Montcalieri observatory. He states that the shaken area extended to the east along a line leaving the plains of Lombardy at Lomellina, and passing by the district of Alessandria to the Riviera di Levante, and westward over all the western Alps, proceeding to-

wards Switzerland as far as Geneva and beyond, and to Paris and Corsica. The centre of greatest intensity was in the Gulf of Genoa, along a line dividing the place where the Apennines join the Alps, and extending from Savona to Mentone. The earthquake spread over the valley of the Bormida, and did considerable damage in a portion of the province of Cuneo, as also in the provinces of Alessandria and Turin, it being very intense on Mont Cenis. It was slighter on the plains and in the valley of the province of Novara. In the places where the earthquake was most intense the principal shocks were three in number, and with a slight difference, depending probably on the difference of clocks, correspond to the times indicated by the seismic instruments at Montcalieri; namely, the first at 6.22 A.M., the second at 6.31, and the third at 8.53. In the places near the centre of motion slight shocks occurred at intervals all through the day. The severest and most terrible shock was the first, which was undulatory in several places, oscillatory, and perhaps rotatory. It was several times prolonged and accentuated. At Montcalieri, as well as at Turin and elsewhere, it had three principal repetitions, plainly evidenced by the courses traced by the registering seismograph. These augmentations of intensity were mistakenly regarded by some as so many distinct shocks. The dominant direction of the first undulatory shock was from west to east, with slight deviations at intervals from west and north-west to east and south-east, and with oscillatory and very slight vibrations. The two other shocks were also undulatory, and the last was rather more intense than the second, but without reaching the intensity of the first. The second and third had about the same direction as the first. The earthquake, in places where it was very severe, was accompanied by rumblings. It will be remembered that slight shocks continued during the following days. These have occurred at intervals since, the latest being reported on March 11. At Mentone and Porto Maurizio these shocks were the most violent ones since Feb. 23.

A scientific and industrial exhibition will be opened at Ekaterineburg in May next. The mining industries of the Ural Mountains will be well represented. Special interest will attach to the department of ethnography, as it has been arranged that there shall be in the exhibition a number of families belonging to the native tribes of the Ural Mountains and Siberia. Their dwellings will be exactly like those in which they usually live, and they will have with them the weapons and implements used by them in hunting and fishing. Another important element will be a collection of ancient objects in stone, bone, clay, and metal, found in Siberia and among the Ural Mountains. These objects have never before been publicly exhibited.

Oxford has agreed, in answer to the representations of the Royal geographical society, to found a readership in geography, bearing all the expense thereof. Cambridge has determined to take a similar step, the geographical society paying half the stipend of the lecturer.

### *Asia.*

The Russian traveller M. Ogorodnikoff was told at Meshed that there are tin-mines near that city and in various parts of Khorassan. In an article in the *Revue scientifique*, M. Berthelot points out that this accords with a passage in Strabo, who speaks (book xv. ch. ii. 10) of tin-mines in Drangiana, the ancient name for the region now called southern Khorassan. If there really have been tin-mines in this district from time immemorial, there can be little doubt that they supplied the tin for the bronzes of ancient Egypt and Assyria.

Krasnof, who was sent out by the Russian geographical society to explore the Khan-tegri, finished his exploration of the Balkash region, and went to Kara-Kul last summer, where he intended to join his companion, I. V. Ignatief. He reports that the river Kara-Soo, which is indicated in the maps, does not exist. He found only a small water-course called Kara-Sai, which is dry at all seasons. All the rivers coming from the mountains of At-lesken are long since dried up. The Ala-Kul has so little water that the Kirghis have been able to cross it on horseback ever since about five years ago, the horses having to swim only fifty yards. In spring the rivers are higher. The water of the west side of the lake is fresh, that of the central part brackish, and in the northern parts it deposits salt. The desert can easily be crossed in all directions, the Kirghis knowing many routes; and, particularly in summer, water may be met with about every forty miles. The river Ili is probably being deflected eastward. The water is stagnant in the beds of its delta, and no floods have occurred in its tributaries during the past three years, while the quantity of water in the Kurlu seems to be increasing. The district of Kaman abounds in woods and reeds. The Kirghis used to cultivate rice here. At the present time wheat is cultivated only in several districts of the desiccated lakes, which require no irrigation. In the Khan-tegri, Krasnof and Ignatief discovered an enormous glacier. When about to cross the frontier of China, they were sent back, as the Chinese authorities were not notified of their intention to visit Chinese territory.

*Africa.*

The Mongalla, one of the northern tributaries of the Kongo, the lower part of which may be seen on the sketch-map contained in the last issue of *Science*, has been explored by Lieut. E. Baert, who ascended it on the small steamer belonging to the station of Bangallas. He followed its course for two hundred and twenty miles, when his progress was stopped by rapids. Its course is very meandering, similar to that of the Biverre. The country around the river is hilly, and inhabited by the Sebi, who are, like other tribes of central Africa, very good blacksmiths. The rapids of the river are in latitude 3° 30′ N., and longitude 22° W. If this position be correct, Junker's Ali-Kobo will probably be a little farther north. The direction of the Mongalla is north-east and south-west: its valley is densely wooded.

Lieutenant Webster, late commander of the station of Stanley Falls, has returned to Brussels, and gives a description of the Mburu, the eastern tributary of the Kongo emptying near Stanley Falls. He ascended the river for two days in a canoe. At the mouth it is about 1,100 feet wide. On the northern side, a little above the mouth, it has a tributary called 'Lindi,' which comes from the north-west and is about six hundred feet wide. The main river is called by the natives 'Ankiambo.' It seems to come from the east. At the farthest point reached by Webster it is eight hundred feet wide. In two places there are rapids. The country is wooded and abounds in elephants. It is inhabited by the Wabeda, who have villages of two or three thousand inhabitants on the middle part of the Mburu.

According to a telegram published in the *Mouvement géographique*, Tippo-Tip has declared his submission to the Kongo Free State, and expressed his regret as to the attack on the station of Stanley Falls which occurred during his absence. As he has a great influence in central Africa, his submission will probably lead to the re-establishment of the stations on the upper Kongo.

The Stanley expedition for the relief of Emin Pasha, which left Zanzibar about three weeks ago, arrived at Cape Town on March 9, and proceeded for the Kongo the next day.

News has been received from Emin Pasha to the effect that in November last he went to Uganda, and that King Mwanga refused to permit him to go through the country. Then Emin Pasha tried to effect a passage out through Karagwe, on the western shore of Lake Nyanza. In this he also failed. He then returned to Wadelai, leaving a detachment of soldiers at Unyoro under the command of Casati, his sole European companion.

*America.*

The missionary E. I. Peck has succeeded in crossing Labrador from west to east. In the winter of 1882, in the summer of 1883, and in the winter of the same year, he failed in his endeavors to reach Fort Chimo in Ungava Bay. In 1884 he started from his station on Little Whale River on July 17, and reached Fort Chimo on Aug. 11. He travelled by boat on the numerous lakes and rivers of the peninsula, and while crossing Clear Water and Seal lakes. The numerous watersheds and rapids of the rivers he passed by making portages. From his journal, which has been published by the *Church missionary intelligencer* in 1886 (p. 510), it appears that the maps are unreliable; but he has not made any observations which would enable us to correct the errors of the maps. The geography of this district is still very little known. It is even doubtful whether the western half of Labrador belongs to the mainland, as, according to some reports, there exists a connection between Mosquito Bay on the east coast of Hudson Bay, and Hope Advance Bay in Ungava Bay.

In the *American naturalist* for January, 1887, Mr. John Murdoch publishes a paper on some popular errors in regard to the Eskimos. He points out that there is no evidence of polyandry among this people; that they do not live in underground dens, keeping up their internal heat by enormous meals of raw blubber washed down with draughts of lamp-oil; and that they are not at all of dwarfish stature. Though we concur with the main points of the author's opinions, we wish to add a few remarks. Murdoch quotes Graah as the only reliable authority who knew by report that the East Greenlanders practised polyandry. The best authority on this subject is Ross, who lived from 1829 to 1833 among the Eskimos of Boothia Felix. In his 'Narrative of a second voyage in search of a north-west passage' (London, 1835, pp. 356 and 373), he refers to two brothers who had one wife, and mentions this as a thing of frequent occurrence. Probably, however, it is not real polyandry, but a state of things brought about by the prevailing custom among them of lending the wife to an intimate friend. Murdoch says that the winter houses in the great middle region, from Hudson Bay northward, are generally of snow, built upon the frozen ground. Throughout this district dug-out winter houses are in frequent use. They have a subterranean entrance, the rear part of the roof being at a level with the ground, and the front being formed by a large whale-rib covered with seal intestines, which admits the light. The roof is made

of beams, over which are spread two covers of seal-skin, the intermediate space being filled with shrubs. In referring to Sutherland's measurements of the Eskimos of Cumberland Sound, Murdoch remarks that they may have been half-breeds. Sutherland visited the Sound only a few years after its discovery; and there were no grown-up half-breeds there at that time, though they form a large portion of the population nowadays. The tribes of that district are in the habit of cooking the food for their regular meals: but besides this, they eat large quantities of raw and frozen meat. They indulge in drinking oil as little as any other tribe. Murdoch remarks rightly that it is far too valuable to waste in this way, as it is the only and indispensable fuel.

## *NOTES AND NEWS.*

THE board of oriental studies at Oxford has added Chinese and Burmese to the list of languages which may be offered in the examination.

— Prof. Edward A. Freeman has been obliged by ill health, the result of overwork, to obtain leave of absence from Oxford for a time. He is now in Sicily.

— The report of the Swiss commission for the reform of gymnasial instruction has just been issued. The commission recommend that the teaching of Latin shall begin in the fifth class, and shall be continued, for five hours weekly, up to the highest class; that instruction in Greek shall depend upon the expressed desire of parents or guardians, and shall begin in the fourth class; and that all scholars who do not learn Greek shall learn either English or Italian. Two spare hours gained by pupils in English or Italian are to be spent in the study of natural science and mathematics.

— The *Educational times* remarks that the event of the month — January — has been the visit of the French teachers to Oxford — the members of the Société nationale des professeurs de Français en Angleterre — for the holding of their sixth annual congress. They lunched at different colleges, and assembled thereafter in Balliol hall, where they were received in a most eloquent speech by Dr. Jowett. That master spoke highly of the value of modern languages and the promotion of their study in England; but he loves his Greek better. "Modern languages in Oxford," he said, "must serve the higher purposes of education: therefore they must not drive out the ancient, and, above all, Greek, which, more than any other ancient language, seems to be the original source of our literature and civilization." Other speeches were made, and the following excellent resolutions were carried: "1. That the Society of French masters earnestly desires to see established at Oxford a school of modern languages, on such a basis as will encourage the study of French literature, and of the French language as a living tongue; 2. That the society desires that the system of set books in the local examinations of Oxford and Cambridge be abolished, and that certificates be awarded on translation at sight, composition, grammar, and *viva voce*." Later, the members dined together at Oriel, where they were entertained by the provost and a committee of reception. Toasts and more speeches followed dinner; Dr. Beljame, the representative of the French minister of public instruction, expressing an eloquent hope that the old friendly intercourse between French and English universities would be renewed. Altogether, the Oxford meeting was a very pleasant success, enjoyable, and of much benefit to all concerned.

— The English educational papers are bewailing the appointment of Sir William Hart Dyke to succeed Sir Henry Holland as vice-president of the council of education.

— Hawaii is not unprovided with educational facilities. The education act compels the attendance at school of all children between the ages of six and fifteen. The government supports free public schools out of a tax of two dollars per head, paid by every male inhabitant of the kingdom between the ages of twenty and sixty years. An inspector-general is at the head of the school department, but no person in holy orders or minister of religion is eligible to fill the office.

— An association for promoting the university education of teachers, consisting, in the first place, of the masters of English elementary schools who spent some weeks at Oxford last summer, has been inaugurated in London. As its first act, the association has appealed to the education department to recognize the university degree as equivalent to a certificate, "provided the universities co-operate by making provision for training in teaching."

— Of late the Prussian minister of education has had several applications made to him to admit women as students at the universities. His reply is, that women are not to be admitted as regular students at any Prussian university, nor at any of the medical schools.

— Cornelius Nepos is a particularly good author for beginners in Latin to take up, because his style is easy and perspicuous, and his subject-matter, when trustworthy, is of historical interest. The

little volume of selections from Nepos that has recently appeared in Macmillan's series of elementary classics is at once the handiest and best-prepared edition for the use of beginners that we remember to have seen. It is edited by G. S. Farnell, M.A., who has prefixed a brief introduction, and appended some helpful notes and a vocabulary. The passages for Latin composition are a good feature, and should materially aid the teacher.

— The programme for the annual meeting of the superintendents of schools, concluded yesterday at Washington, was a comprehensive and attractive one. The subjects of discussion, and the speakers invited to discuss them, were as follows: 'Public education on the Pacific coast,' Superintendents Campbell of Oakland (Cal.), Waterman of Stockton (Cal.), and Fay of Eureka (Nev.); 'A teacher's certificate, county, city, state, and national,' Dr. A. J. Rickoff of Yonkers, J. P. Wickersham of Lancaster (Penn.), Dr. W. A. Mowry of Boston, Superintendent Lovett of Huntsville (Ala.), W. W. Jones of Lincoln (Neb.), and Superintendent Hard of Gallipolis (O.); 'Civil service and public schools,' L. D. Brown of Columbus (O.), Superintendent Manley of Galion (O.), B. L. Butcher of Beverly (W.Va.), Superintendents Morgan of West Virginia, Barringer of Newark (N.J.), Littlefield of Newport (R.I.), and Ballard of Columbus (O.); 'Powers and duties of officers and teachers,' Superintendents Marble of Worcester (Mass.), Cornell of Denver, Hinsdale of Cleveland, Wise of Baltimore, Latham of Danville (Ill.), Green of Long Branch (N.J.), and W. E. Sheldon of Boston; 'The best system of county and city school supervision,' Superintendents Holcombe of Indiana, Greenwood of Kansas City, Johnson of Columbia (S.C.), Sabin of Clinton (Io.), Paine of Tennessee, Speer of Kansas, and Macdonald of Topeka; 'The best system of state school supervision,' Superintendents Easton of Louisiana, Edwards of Illinois, Preston of Mississippi, Pickett of Kentucky, Lawhead of Kansas, Palmer of Alabama, Buchanan of Virginia, and Tomlinson of Winston (N.C.); 'The relation of our public schools to the general government,' Congressman McKinley of Ohio, A. J. Michael of Cleveland, and Superintendents Newell of Maryland and Cooper of Texas.

— Writing from Paris, the *Journal of education's* correspondent mentions two subjects of general educational interest. The first is, that there is at present a perfect glut of teachers in the scholastic market in France. The impetus given by the republican government to education has caused such an influx of young men and young women to the profession, that more than twenty thousand who have gone through the necessary training and passed the examinations cannot find places. Most of these would, under ordinary circumstances, not have become civil-servants; and the increase in the number of these, in a country where the true function of the state is considered by too many to be that of providing posts for its citizens, is a very serious matter. The second topic of interest is that the Chevé method of singing at sight is gaining ground in France, as well as in Belgium and Holland. Although not so thorough in fundamental principles as the tonic sol-fa method, which has done such a vast deal for singing in England, this method stands next in order of merit. The degrees of the scale are indicated by figures, instead of by letters as in tonic sol-fa. He adds that it is a curious fact that Germany, where rational and irrational methods on every possible subject are being daily elaborated with exemplary care and Teutonic patience, still plods on with the old method, which has but one point in its favor compared with the above-named; namely, that it is the only possible method, practically speaking, for instrumental music. But as a means of affording a ready insight into the principles of modern music, it can hardly be called a method at all.

— The *Athenaeum* reports that a movement in favor of university extension, somewhat after the lines of Professor Stuart's scheme, which Cambridge has worked with signal success, is being proposed in Scotland. The University of Glasgow is considering the subject, and St. Andrews has formed a committee which is to inquire into the need for instruction and its capability of supplying it. Several of the Edinburgh professors have signed a rather vague fly-sheet that has been put in circulation; but no general conclusion has been reached, and it is uncertain whether the universities will divide the work among them, each acting separately, or whether there will be a common organization. In fact, the question in Scotland takes a different form from what it does in England. England had a large body of comparatively idle fellows: Scotland has none. When Professor Stuart began his work, there were large districts in England untouched by university influence: there is almost no such district in Scotland. The number of undergraduates at Oxford and Cambridge is small in proportion to the population: the number of Scottish students is very large. These and other circumstances will compel the Scottish universities to handle the question in a way somewhat different from that pursued by Professor Stuart.

## LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Zoology in the college course.

THE recent appearance of three zoölogical text-books, so diverse in treatment as to be well-nigh contradictory, revives the question, 'How shall zoölogy be taught?' The three books to which I refer are Packard's 'Zoölogy,' Colton's 'Practical zoölogy,' and Sedgwick and Wilson's 'General biology.' The first of these has already proven its popularity by passing through several editions. But popularity and real merit are not identical in meaning. Professor Packard's work is a conspectus of the animal kingdom: it may justly be termed an elementary study of the classification of animals. The student is constantly brought to view orders or classes as exemplified in a few types selected for study.

Sedgwick and Wilson designed their work for college use. The latter part of it is an introduction to the study of zoölogy. It is the counterpart of Packard's 'Zoölogy.' In it the principles and facts of classification are not first in importance, but the student is kept upon the study of one animal until he has mastered it from every stand-point, — anatomical, histological, embryological, and also to some extent physiological.

Colton's 'Practical zoölogy' occupies a place between the other two. It was not designed for use as a college text-book, and we should not speak of it here but for the fact that it will be used in many colleges, and we consider that it has serious limitations if used for this purpose, and should be largely added to, to make it capable of doing proper service. The work is virtually a set of superficial studies of the gross anatomy of a variety of animals arranged without reference to classification. Only the most easily seen features in the anatomy are touched upon, and all the more difficult ones are omitted.

We consider these text-books as representing two distinct ideas in zoölogical teaching, and the third a compromise between them: first, the view that the student of zoölogy should have at least a glimpse at every large group in the animal kingdom; second, the view that the student should have a very full fund of information about a very few forms; and the third, the attempt at bridging the chasm between them. The first view leads to superficial knowledge of the whole, the second to thorough knowledge of a part, and the compromise secures neither result.

Before considering the relative merits of these two ideas, we must be careful to make it understood that we are speaking now of a college course in zoölogy, and neither, on the one hand, a high-school course in natural history, nor, on the other hand, a professional course in zoölogy. Zoölogy is not taught in college to make zoölogists: it should guide such study of the phenomena of animal life as will best increase the powers of observation or quicken the activity of perception, but, at the same time, not omit to acquaint the student with the principles of the science, and ground him well for future deeper study, should he ever wish to pursue it. If the college course has, then, this twofold purpose, — to develop the student's powers and to show him somewhat of the science of zoölogy, — two questions arise: what is zoölogy as a science, and does it train the mind aright by its pursuit?

Zoölogy was advanced from a dry collation of ill-understood facts to a living science, and with this growth its study has outgrown its old place in the curriculum. The progressive colleges give it more prominence and a strong force of instructors, and furnish laboratories, etc., for work. Even the most conservative have seasoned the ancient and dishonorable practice of a course of lectures on zoölogy without any laboratory work, with some work upon the animals studied. With this change should go the desire, dear to so many instructors' hearts, to inform the student with all the facts he has gathered after long toil. As we discard the false notion that even the briefest course must still include some knowledge of every group, and realize that by 'elementary' we mean, not more dilute knowledge of a great variety of creatures, but thorough knowledge of fewer, we are in a position to use the laboratory for its legitimate purpose. This purpose is to study animals as the zoölogist studies them, not fully enough to learn all zoölogy, but fully enough to intelligently understand the work of the zoölogist, including the student of physiology and pathology, securing at the same time zoölogical training just so far as the study is pursued. It is all wrong and pernicious for the teacher to feel that he must get his class 'over the ground.' There is no limit to the amount to be done, and he can't 'go over the ground' except most superficially. The feeling that each large group must receive some attention, however slight, is really most harmful, though very wide-spread. The experiment is tried every year of making students apprehend principles before they have mastered enough facts, and it is always most unsatisfactory in its results.

Zoölogy is not at the present time chiefly concerned in the discrimination of species, which forms but a minor issue; but the bulk of study is in the direction of anatomy and histology, embryology and physiology. These studies all lead later to the consideration of many very difficult problems, and among them those of classification; but the zoölogist is not in a position to attack these at the outset of his study. At first he must pursue many little details, tiresome or fascinating as the case may be, such as fine dissection, section-cutting, with minutest attention to the processes of hardening, staining, embedding, cutting, and mounting, careful study and interpretation of sections, various careful experimental observations, and all these attended to with all possible precision. No one has a right to claim a notion of the science of zoölogy who has not had considerable training in such work, met some of its difficulties, and thus acquired information for himself along the arduous road of the zoölogist. Furnished thus with facts, he is ready to take some of the higher steps of the scientific zoölogist and seek the law which unifies his observations or the general principle which underlies them. How valuable an idea of the cell, its derivation, differentiation, etc., has one who has gotten his idea of cells from blackboard drawings? But let him study the growth from embryonic epidermis of skin, hair, nail, and gland, and differentiation begins to take on meaning.

While only direct observation can give the student an adequate conception of the science of zoölogy, it at the same time secures to him the very best for which natural science training is of educational value. It is not so much the variety of observations as their exactness which produces valuable results in this direction. Nothing so irksome as exactness, nothing

so unusual, but nothing so desirable in education, whose purpose is, not to make things easy, but to strengthen ability to master difficult ones. It is just this training which zoölogy should furnish.

It may be set down as certain that in the brief time usually allotted to zoölogy in college no student can master both the technique of zoölogy and a complete survey of the classification. It is also certain that he cannot acquire without laboratory work a zoölogist's conception of, we will say, a crustacean. He may dissect a cray-fish and then be informed that it is a crustacean, in which case he merely understands the terms 'cray-fish' and 'crustacean' to be synonymous. But let him take a cray-fish or lobster for his first study; let him dissect it and study its cellular structure; let him study its larval stages. From it let him go to other macrourans and compare their forms, all the way from *Gebia* to *Hippa*. Let him have access to the systematic treatise, and hunt out the genus and species. Let him compare it with the schizopod and the crab, and with the megalops of the crab, and he will then form some adequate conception of the zoölogist's meaning of a crustacean.

We believe this to be the true way to teach zoölogy, for we doubt the value to a man of a mass of indefinite ill-digested text-book information. Occasionally an omnivore can take in every thing, and digest and so metabolize it as to organize it into healthy mental tissue. They are, however, the few.

If the requirement of zoölogy from a text-book be such as this outline would indicate, obviously no text-book can ever fully meet it. For the systematic work no smattering key but the original description should be consulted if possible. Upon the anatomy and histology the student should have the use of original articles, monographs, etc. This is, however, not always possible, but the nearest approach to it should be the chosen course. Sedgwick and Wilson's work comes the nearest to being such a text-book of any with which we are familiar. We should have preferred the selection of some animal with a larger circle of cousins and other relatives, both near and distant, and think that a crustacean or a coelenterate might be taken to exhibit better the science.

It will mark a long stride of improvement for the science of zoölogy when teachers and examiners will be content to allow the student to become broad only after he has been narrow, in place of exacting of him a large amount of varied information which is only skin deep, will foster and encourage methods of work which will make him the master of the facts. The real test of the merit of a zoölogical student should be made to lie in what he can do, how much he can see, — his ability to demonstrate facts in zoölogical science, and not merely or chiefly, as at present too largely, in how much he knows.

L. H.

## Elementary instruction in zoology.

Seldom have I read an article, among the many that have been recently published dealing with that all-important question as to why biology should constitute one of the leading educational branches in the schools and universities, with more interest than I did the one contributed by Prof. H. W. Conn, and published in the issue of *Science* which appeared upon the 18th of last month.

To my mind, it not only presents in the most masterly manner why biology should be introduced into the curriculum of every grade of school, from the primary classes to the university, but how, within the near future, such a happy result will with great certainty come about.

I can remember very well how, a number of years ago, I read with the keenest interest all of Huxley's now classical essays upon this subject, and watched the untiring efforts of his to force upon the attention of those in authority in educational matters in England the prime importance of an early introduction of the biological studies not only into the graded schools, but into the curriculum of every university.

There are many, many teachers and educators in this country to-day that now hold the views of Huxley in nearly all essential particulars; and those who have thoughtfully followed, step by step, the growth of the natural sciences with us, since the early days of this century to the present hour, know full well that the time is not far distant when the education of the individual will by no means be considered a liberal one, unless it comprehends a very clear understanding of the principles of biology in their widest sense.

For more than a quarter of a century it has been my good fortune to have been able, in common with others of my date in the fields of science, to watch and study the several highly interesting phases through which the natural sciences have successively passed. These phases seem to divide themselves naturally into three quite well-marked stages; and these stages may be characterized by comparing them with the way in which any animal or group of animals has been studied. In times gone by, naturalists dealt first with the mere description of animals, — the narrative stage, as it were, — and the literature of the subject partook almost exclusively of this style of treatment. But as the knowledge of animals became more accurate, and freed of its mythical taint, why, then the needs of the minds of men demanded more than this, and the subject naturally passed into its second stage, and the study became highly classificatory. Classification reduced the enormous amount of almost chaotic descriptive literature to order and system. Next the study of the natural sciences gradually passed into its third and present stage, wherein classification is being checked and corrected by the wide-spread attention that is being devoted to the subject of structure, — the morphology of animals. It is needless for me to add here that the outcome of the present phase is slowly bringing to light a knowledge of the fundamental life-principles of organized nature, and an understanding of the universal laws that apply to the whole.

As the pressure of the necessity for the teaching of biology in the schools became greater and greater in recent times, it was soon followed by the outcropping of the text-books to be used for the purpose; and it has been with the very deepest interest possible that I have studied the casting of these very volumes. Some of them have still clinging to their pages many of the traces of the 'narrative' phase of the science; others are largely classificatory; while still others, intended even for the youngest minds, deal chiefly with morphology, — with healthy hints of a juvenile calibre, at the underlying principles of life, judiciously introduced.

From this point, space now demands that I be brief in my remarks; and I will, in concluding, simply present my matured views upon the subject of elementary teaching in biology, irrespective of any of

my reasons for holding them, or any defence of my convictions in the premises.

As to the age at which children should first take up the study of biology, I contend that it largely depends upon the aptness of the individual child, and the capacity for teaching of the instructor. My oldest son is not yet quite ten, and he can pass a stiff examination upon Morse's 'First book in zoölogy,' name the bones of the vertebrate skeleton, comprehends the general principles of a natural classification, reads well, and has his other studies fully up to those in biology, and, finally, makes an unusually creditable drawing *direct* from any natural object. I would say, then, to those children to whom all the advantages of the schools are open, that they may safely begin with their first steps in zoölogy and biology at nine years of age.

As to the methods, I would say, then, for a child of nine years of age, that mere descriptive zoölogy be simply considered a part of his general reading; that such training as comes from the study of the naming of animals I would surely confine to a very limited list of the commonest forms of the several groups, but let these be thoroughly understood; and I would say right here, that, even at this age, it is truly wonderful how well a child can comprehend the general principles of nomenclature, if they be properly presented to him. Even clear through the university course, I am by no means an advocate of the student putting forth the effort to commit to memory the names of animate objects, even so far as they apply to the fauna of his own country. Coming next to classification, I would say that this, too, be borne upon but lightly at first, though *its principles* can be introduced at a very early stage in the programme of biological education. What I object to, is the early course of zoölogical studies being based upon any system of classification. I agree with Professor Conn when he says that "classifications have, by reason of recent discoveries, grown so intricate and complicated that they no longer can be taught to the general student with any degree of satisfaction." But the principles of classification, as I say, can be easily made clear to the child; and it soon learns to grasp these, and prattles quite learnedly as to why bats are grouped with the mammals, and whales are not fishes!

By this time I expect my views upon this part of the subject have been anticipated; and I hasten to say that my firm convictions are, that the principle upon which biology should be taught to children, is to begin with the study of TYPES. Not only that, but I contend that it is the question of a study of types that should be held to, all the way through the entire course of study, until the day of graduation at the university.

And, figuratively speaking, at all ages these studies must be pursued with text-book in one hand and the actual specimen in the other, with the lens and scalpel constantly at work.

If we start in with a child nine years of age, and commence to carefully point out to it, constantly using fresh specimens, all that can be learned from the body of any *one kind* of small animal, appropriately illustrating it as we proceed with a sufficient number of the proper kind for comparisons, and introducing at the same time the simpler laws of chemistry and physiology, it is absolutely marvellous the interest that can be aroused, and the progress that is the outcome of it all. Children soon learn, too, to make wonderfully good sketches of their work, and may be easily taught to compare them, and lay them aside for future use.

The text-book for this purpose, treating, as it ought to, of a few types, should be thoroughly and carefully illustrated; and none of the systems should be in any way neglected or hastily passed over. Take the muscular system, for example. For children nine years of age, it will only be necessary to illustrate the larger and more important muscles of the trunk and extremities, but good figures of them must be given in the text-book; and, say the instructor has before him as his type some such an animal as a squirrel, he can easily lay bare the biceps in the fore-limb, and, in an attractive way for children, speak of the composition of a muscle, show the physics involved in its leverage, and say how it is found in most all vertebrates with fore-limbs, how in mammals it is inserted into the radius, and in many birds into the ulna; its presence in ourselves can at once be demonstrated upon any child present; and so on. Lessons of this kind, I know from personal experience, are entered into with a growing interest, and are pursued with an ever-increasing profit.

So far as I know, to my mind, the text-book in zoölogy and biology, for the use of our children from nine to fifteen years of age, remains yet to be written.

R. W. SHUFELDT.

Fort Wingate, N. Mex., March 5.

## Thought-transferrence.

I read with much surprise Mr. Edmund Gurney's letter on the article of which I gave an account in *Science* of Feb. 4. I thought I had made it quite clear that I was simply saying, in part in my words but mostly in their own, what two ladies had written on an overlooked factor in thought-transferrence. As these ladies have so clearly proved their ability to speak for themselves, I will take the liberty of forwarding them a copy of Mr. Gurney's letter, and, if they think it advisable, they may answer it.

The reason why I consider the article important is because it tells us something new and interesting about the 'number-habit,' not on account of its bearings on thought-transferrence. The latter point of view, however, was that which interested the authors of the article, and I thought it better to adopt their form of statement. The bearing of this fact on psychic research is to me of rather trivial interest compared to the psychological value of the fact itself. I fear there is great danger of magnifying the importance of psychic research in general, and of forgetting that it forms only a small and that rather an unimportant part of psychology.

It seems to me perfectly fair for the writers of the article in question to omit any detailed reference to the work of the English society; and I, for one, did not draw from it the inference which Mr. Gurney draws, — that they suppose the argument to apply to *all* the work of the English society. I do believe, however, that the principle has a very much wider application than Mr. Gurney supposes. The writers of the article in question took for granted some acquaintance with the work of the English society; and the charge of misrepresentation seems to me unfair against them, as I hope it is also unfair against my account of their article.

It can hardly be of interest to any one but myself to know that Mr. Gurney's own attempt at 'thought-

transferrence' has been a failure. Not only have I read every page accessible to me of the writings of Mr. Gurney and his associates, and have begun reading the 'Phantasms of the living,' but, on the whole, I have spent more time in this department of literature than I care publicly to confess. The only justification with which I console myself for all this reading is the glimpse here and there of an interesting illustration of the psychology of 'psychic research' itself. If I have overestimated the importance of the article I reported, it may have been due to the bright contrast it afforded to so much of the literature on that topic with which I have come in contact.

J. J.

Baltimore, Md., March 12.

To some of the facts brought out by the English branch for psychical research, and which seem to me well established, — quite as well, indeed, as many facts in physical science which scientists accept because they cannot explain, — the American branch of the same society enters its demurrer. "The tests of so-called investigators have been rendered quite unreliable by the fact that they were themselves the dupes of their own ideas." Now, the investigator *may* be the dupe of his own fancies, — that is most true, — but his fancy may be a susceptibility favorable to the fact, or a non-receptive susceptibility, that would require more than a logical train of possibilities to dispel. He may be such a slave of sceptic habit, that the normal freedom of his judgment is weakened by preconceived ideas so tyrannical as to make of him a bigot. In scientific investigation the one man is as worthless as the other, — on the one hand, the scientific man who *will not* be convinced; and, on the other, the one who will be too easily convinced.

Humanity is made up of compounds pretty well known; and it seems hardly probable, that given the same opportunities, and with mental calibre of equal power, the English men of science should be the victims of their own fancies to a larger degree than those in the United States. So I take it that dupe No 1 prevails in Europe, and dupe No. 2 in America. It will always be found difficult to explain psychological phenomena upon physical bases, — more than difficult: it is impossible. The theories followed out by the American branch do not seem to me to be applicable. In the first place, it is not a fact in mental science, that because the power of thought-transferrence occurs in one person, it must occur to a certain extent in all persons, or in at least a great many persons; and I very much question the existence of any mental system constructed upon the relation of the digits or the determination of numbers. Starting out with these preconceived, firmly rooted, and untenable hypotheses, the investigator has already made himself the dupe of an idea. He is the victim of the society's explanation. He comes to the work totally unqualified as an unprejudiced observer, because he is already prejudiced by preconceived trains of thought, originated by the society to which he belongs, and exaggerated by his own in-dwelling upon the subject. He has withdrawn from mental freedom something absolutely necessary to its unfettered action, and cannot give to the investigation that just and honest study which alone can be of service. The number of men in the world's life capable of passing such judgment is exceedingly small: they could be counted upon one's fingers. A man may be reverenced in the realm of letters, of astronomy, of medicine, of natural history, etc., and yet it is more than probable that he cannot bring to a crucial test of psychic phenomena the freedom of judgment that is necessary. In the very nature of things, I should doubt most strongly if a physicist is ever the proper person to pronounce upon metaphysical processes, because his whole habit of thought has been in a different direction.

To accept nothing as positive that has not been proved dwindles our world down to the geometrical conception of a 'point,' which has position without dimension: it makes of human life a mere idea, that as yet lacks logical method, and is without definite fashioning; and robs every one that takes the life-giving oxygen into his lungs without knowing why he does it or what ultimate purpose it subserves, of the very sweetest hope that a student can have, — that some day the mysteries that now torment us shall be made as clear as the noonday sun. This is not the test of psychological phenomena, and never can be.

I can understand, from a very considerable experience in hospital work on the continent, that many conditions of self-deception are self-created. A man may be the victim of excessive introspection, and may conjure up mental states of being and mental imageries which to him are absolute. Another may receive into a ductile mind as truth certain disputed ideas, because he has already tilled the ground for the reception of the seed. Another will fail to receive any thing, because he has determined either that he will not, or that, if he does, it will conflict with his preformed scientific conception of the matter. Both of these latter are certainly dupes. I have seen a few examples of thought-transferrence; but even the few were so unmistakably the evidences of a new force or power, and so free from any suspicion of fraud, that I cannot deny the possibility because I am unable to explain the fact. I certainly do not incline to relegate such power to the mere rudimentary conditions of elementary human life; neither has it been my experience to find that the agent or percipient were persons in whom the intellects were at all weakened. We know so little of consciousness, of brain-power, and of the power of the senses, that we should blushingly announce ourselves as ignorant and blind, before opening the door that leads to regions of which the wisest know absolutely nothing.

I am writing merely as my thoughts suggest, and not at all as one versed in this the most abstruse of all sciences; and these thoughts have been called out by a study of the plans and purposes of the society for investigating these phenomena. It seems to me that the ends and purposes aimed at are handicapped at the outset by certain definitions and premental conceptions that must be more or less dominant, and thus tyrannize over the understanding; so that the very man who thinks himself free becomes the dupe of preconceived ideas. The instinct of the animal that leads him to interpret certain moods of his master, and which is of a part with the whole transmission of heredity, — the automatic action, so to speak, of the higher nervous ganglia, or the impress that these ganglia have acquired by similar experiences through hundreds of preceding generations, — is quite another thing from the complex phenomena of thought-transferrence, which are the exponents of a much higher degree of civilization, calling for a much more elaborate and intricate association of psychic functions.

If even the least significant of all of the facts reported from England be accepted, we are left to deal with an unknown something quite apart from instinct, — something, for so it seems to me, which cannot be compared with it in any way, but which is the evidence of a higher order of brain-manifestation than we have yet met with.

HORATIO R. BIGELOW, M.D.

Leipzig, Feb. 28.

## The tail of Chlamydoselachus.

A recent opportunity of examining a second specimen of Chlamydoselachus furnished the means of adding an item or two to our knowledge of that peculiar genus. In several points the example differed from that originally described. This was notably the case with the tail. On the later capture, this organ was a little more than one-fourth of the total length, and, with the vertebral column, tapered to a sharp extremity; whereas in the first one it stopped abruptly, with vertebrae of considerable size, as if truncate. On the new one, the lateral line, with a few short breaks posteriorly, continued to within an inch of the end of the tail. All this indicates that the tail of that which served as the type was deformed and incomplete: the deformity, in all likelihood, being of embryonic origin. Proportioned as the new one, the tail of the type would have been seventeen inches long, instead of which it was but little more than ten. Completed, the type would have had a total length of sixty-six inches, to a circumference of eleven and a half. The more recent specimen had a length of forty-eight, to a circumference of ten and a half inches, which made it rather less slender and snake-like than its predecessor.

Another difference occurred in the dentition, which, in the last examined, showed variations in the number of denticles between each lateral cusp and the median: sometimes there were two, sometimes but one.

The tropeic folds, abdominal keel, were present, as on the specimen from which the original description was taken.

S. GARMAN.

Cambridge, Mass., March 11.

## The Quebec group.

Thinking it may be interesting to geologists to learn the latest conclusions in reference to the stratigraphical succession and distribution of the rocks in the province of Quebec, hitherto known as the 'Quebec group,' I send you the following brief observations on this subject: —

As is well known, the divisions made by my predecessor, the late Sir W. E. Logan, of this interesting and exceedingly complicated group of formations, were in ascending order, — Levis, Lauzon, and Sillery, — and these together were supposed to represent a peculiar phase of the calciferous and chazy formations of the New York lower paleozoic series. I have elsewhere made known as the result of personal investigation that portions of several systems and formations had evidently been included in the Quebec group as described in the 'Geology of Canada, 1863,' and depicted on the geological map of Canada, published in 1866. During a personal examination of a large portion of the area during the seasons of 1876, 1877, and 1878, I recognized strata which I considered clearly belonged to systems and formations ranging from pre-Cambrian to Silurian; and also that much of the so-called 'Sillery' was in reality not the youngest, but the oldest member of the group, and of pre-Cambrian age.

All subsequent investigation has confirmed the correctness of these conclusions, first advanced in a paper read before the Natural history society of Montreal in February, 1879, and more fully treated in reports and papers since published in 1880, 1883, and 1884. Since the date of the last of these publications, considerable additional information relating to the distribution of the several formations has been acquired; and I now find that no less than four distinct horizons can be recognized, each of which is marked by important bands of conglomerate. Three of these (Nos. 2, 3, and 4) are fossiliferous limestone conglomerates, while one (No. 1) is chiefly felspathic and dioritic, is non-fossiliferous, and generally presents the appearance of a volcanic agglomerate or breccia, which in places becomes a brecciated serpentine, or is otherwise variously altered, and is often schistose and micaceous, — pre-Cambrian.

No. 2 is of Cambrian age, and is best seen along the south shore and at the north end of the Island of Orleans, at Bic, at Metis, and at several points lower down, on the south side of the St. Lawrence Gulf.

No. 3 is the celebrated Levis conglomerate, well exposed at Point Levis and at the south-west end of the Island of Orleans. It is interbedded with gray and dark blue highly graptolitic slates, recognized by Professor Lapworth as marking the phyllograptus zone of Europe. It also recurs with its associated phyllograptus slates at several points between Metis and the Marsouin River on the south shore of the St. Lawrence, always in discordant contact with the strata of the preceding group.

No. 4 is the limestone conglomerate of the Quebec Citadel Hill. It occurs there in three or four more or less lenticular beds, none of which exceed six feet in thickness: they are associated and interbedded with black highly carbonaceous and graptolitic strata, yielding a valuable cement-stone. Both to the north-east, before reaching the Island of Orleans, and to the south-west, these beds are cut off by the curving line of the great St. Lawrence and Champlain or Appalachian fault, and are brought into abrupt contact with the red and greenish gray slates of No. 2. They appear again, however, on the south side of the St. Lawrence near St. Antoine, and thence pass beneath the drift-covered level country to the south-west. I believe these beds to be a part of the Utica, Hudson River, or Lorraine group. Professor Lapworth, who has recently examined the graptolitic fauna from these rocks, considers it to denote a stage older than Trenton limestone, but decidedly newer than the Levis phyllograptus zone. The latter view is entirely in accord with the stratigraphical evidence as first published by me in 1879; but, so far as the stratigraphy is at present known, it is as decidedly opposed to the former conclusion. Lists by Professor Lapworth, of the graptolites from the different horizons above named, will appear in the volume of the Transactions of the Royal society of Canada, shortly to be published.

The fauna of No. 2 conglomerate, as well as that of the associated slaty and shaly beds, is exclusively of Cambrian type, — Dictyonema sociale, Eophyton Linneanum, Cruziana (?) Paradoxides-Archaeocyathus, etc.

The fauna of No. 3 conglomerate is mixed Cambrian and lower Cambro-Silurian, while that of the associated slaty beds is exclusively lower Cambro-Silurian.

The fauna of No. 4, though also mixed, is chiefly of Trenton Lorraine age, as is that of the associated slates.

The mineralogical and lithological characters of the four groups are as markedly different as are their paleontological features, and the former present a striking correspondence with those which characterize the pre-paleozoic and lower paleozoic formations of the Lake Superior region.

Altogether the structure in the vicinity of Quebec seems to correspond very closely with that described by Mr. S. W. Ford in his 'Observations upon the great fault in Rensselaer county' (*Amer. journ. sc.*, vol. xxix. January, 1885).

In the Quebec area the great fault not only exists, but has many subordinate and more or less parallel branches. The most important of these crosses the main Quebec anticlinal at Danville, in Shipton township, and runs thence south by the Missisquoi valley to Mansonville, in the township of Potton, on the Vermont boundary. In many places these dislocations have, as described by Mr. Ford (*op. cit.*), placed the older rocks on the top of the newer. Such an occurrence is well seen in the gorge of the Nicolet River near Danville, where the black Cambro-Silurian limestones and shales dip directly under gray wrinkled quartzose pre-Cambrian mica-schists, and one would suppose the two series to be in conformable sequence; but not far removed, in the township of Tingwick, a small outlier of the same black limestone rests flat on the upturned edges of the mica-schists, as do other similar outliers elsewhere in the district.

It is quite evident that Appalachian geology can never be satisfactorily interpreted and explained without careful and minute study in the field of the numerous great shoved, more or less parallel, faults by which the whole region has been affected, and due consideration given to the marvellous effects they have produced on the structure.

ALFRED R. C. SELWYN.

Ottawa, Can., March 9.

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### Notes upon the erosive power of glaciers as seen in Norway.

The above heading is the title of a paper in course of preparation, of which the following is a *résumé* in part: —

(*a*) As many of the Norwegian glaciers are rapidly advancing, they arch over from rock to rock, and leave sub-glacial caverns into which the explorer can go long distances.

(*b*) Numerous angular and sub-angular stones, as well as those rounded by atmospheric erosion, are resting upon the crystalline rocky beds with the ice flowing about them; that is to say, the resistance due to the friction between the stones and the rock is greater than the cohesion of the molecules of the ice, which flow about the obstacles as a viscous body. Even stones resting upon loose and soft morainic matter, over which the glacier is advancing, are sufficient to channel the ice as it moves over, in place of pushing it along.

(*c*) No blocks were seen in the act of being torn up from the subjacent rock, nor were the loose stones being picked up.

(*d*) A large rounded bowlder, held in the ice, was being rolled, in place of shoved, along by glaciers, as shown by the mouldings in the ice. At the same time, it was being crushed.

(*e*) The abrasion by the falling of detached masses of ice and stones is considerable.

(*f*) A tongue of ice, hanging from the roof of a cavern, was pressing against a loose bowlder, that a man could have moved. In place of pushing the stone, or moving around it, the tongue of ice, of about a cubic yard, was being held suspended by a sheet of ice bent backward, nearly at right angles, in a graceful curve.

(*g*) Scratched stones were rarely seen among those falling out of the bottoms of glaciers, and in many places the rocks were scarcely, if at all, scratched. Although occasionally highly polished, the subjacent rocks, even where scratched, showed generally surfaces roughened by weathering, or with only the angles removed.

(*h*) The upper layers of ice were seen to bend and flow over the lower, wherever low barriers were met with, in place of the lower strata being pushed up by an oblique thrust.

(*i*) A glacier was advancing into a morainic lake, and, in part, against the terminal barrier. In place of ploughing up the obstruction, the strata of ice were forced up into an anticlinal, along whose axis there was a fracture and fault. Thus domes of ice covered with sand were produced. The sand had been deposited upon the surface of glaciers by the waters of the lake. The conformability of the sand and the strata of uplifted ice was undisturbed, except along the line of fault. As the domes melt, cones of sand with cores of ice are left. By the lifting process the morainic barrier is covered with clayey sand, as if subjacent strata had been ploughed up by the glacier, of which there was no evidence.

(*j*) At several places where glaciers are advancing over moraines, they are levelling them, and not ploughing them out. This levelling process is by the dripping of the water from the whole under surface. In fact, even the loose stones upon the water-soaked moraines were sufficient resistance to cause the bottom of the ice to be grooved.

(*k*) The fall of a great ice-avalanche from a high snow-field, down a precipice of a thousand feet, to the top of a *glacier rémanié* was seen. These falling masses of ice bring down the frost-loosened stones from the sides of the mountains upon the glacier, which is charged with *detritus*. It is this material which furnishes mud to the sub-glacial streams, and not the rocky bed of the valley worn down by glacial erosion.

(*l*) One does not find that the glaciers *per se* are producing hummocks. These are the result of atmospheric and aqueous erosion, although perhaps beneath a glacier, which sweeps over them, and to some extent scratches and polishes them. The effects of glaciation in removing angles and in polishing surfaces are small compared with atmospheric erosion upon the same rocks.

(*m*) The transporting power of glaciers is limited to the *débris*, which falls upon its surface from overhanging or adjacent cliffs, and afterwards works through the mass or comes to be deposited at its end.

J. W. SPENCER.

University of Missouri, Feb. 28.

# SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 18, 1887.


## SLÖJD[1]

I HAVE been asked to give some account of the slöjd system, as practised in Sweden, having lately visited that country in order to study the system both practically and theoretically. This visit convinced me of its excellence, of its claim to be regarded as an important factor in education, and the need there is for something of the kind in our own schools.

The word 'slöjd' is essentially Scandinavian, and an equivalent for it is not to be found in any other European language. Its original meaning is 'cunning,' 'clever,' 'handy' (compare '*sleight* of hand'), but, as at present used, it means rather the different kinds of hand-work used in schools for educational purposes. 'Slöjd' is such a convenient word, and embraces so much, that I think we shall have to naturalize it in England, and call it 'sloyd.' It has already been adopted in France and Germany, and I believe in Belgium, Austria, and Russia.

There are many kinds of slöjd, or hand-work, practised in the schools in Sweden, Norway, Denmark, Finland, Germany, and other countries, — simple metal-work, smith-work, basket-making, painting (trade), fret-work, book-binding, *papier-maché*, needle-work, and finally wood-slöjd, which consists mainly of carpentry, but in which carving and turning may play a subordinate part.

Herr Otto Salomon, the director of the seminary at Nääs, has drawn up a table in which the above occupations are compared, under the following heads: —

1°. The children's interest gained; 2°. Work which can be used; 3°. Order and precision; 4°. Cleanliness and neatness; 5°. Development of sense of form; 6°. Accordance with children's capacity; 7°. Strengthening and developing of the physical powers; 8°. Counterpoise to sitting; 9°. Capability of methodical exposition; 10°. General dexterity.

It appears, from a careful comparison of the results obtained by means of these various occupations, that while several of them answer to the above tests in certain particulars, yet only the *wood-slöjd* can answer all.

I will endeavor to give a brief outline of the chief principles of the method for the teaching of manual work which is followed at Nääs, and which has thence been largely disseminated all over Scandinavia and Finland, and is taught even within the arctic circle. In Sweden alone, wood-slöjd is practised in eight hundred national schools, has been introduced into the secondary schools for boys, and is now being adapted even in the upper schools for girls.

It has also been introduced into France, Belgium, Germany, Austria, Russia, and the United States. It will probably be taken up in Abyssinia, through the instrumentality of the Swedish missionaries; and even far-distant Japan is showing an interest in the subject. Are we English to be left hopelessly behind in the adoption of hand-work as an important factor in education? We have already accepted it — in a very limited way, it is true — in the adoption of the kindergarten system, the very soul of which is its response to the child's need of activity and production; and slöjd is the same principle at work, only in a form suited to the growing powers of our boys and girls.

Herr Salomon himself has treated of the results aimed at by slöjd, the choice and classification of models, and the question who is to be the slöjd teacher, in a work which has already been translated into French and German, and will soon, I hope, appear in English.

Slöjd aims at the following results: —

1°. To implant respect and love for work in general; 2°. To implant respect and love even for the coarser forms of honest manual work; 3°. To develop activity; 4°. To foster order, accuracy, cleanliness, and neatness; 5°. To encourage attention, industry, and perseverance; 6°. To develop the physical powers; 7°. To train the eye and the sense of form.

The joining of the slöjd course should be voluntary on the part of the pupil: consequently the work should fulfil the following conditions: —

1°. It should be useful; 2°. The preparatory exercises should not be too fatiguing; 3°. They should offer variety; 4°. They should be executed without help; 5°. They should be real work, not play; 6°. They should not be knick-knacks, or so-called fancy-work; 7°. They should belong to the worker; 8°. They should be in harmony with his power and physical strength; 9°. They should be of such a nature that they can be finished with exactness; 10°. They should allow of cleanliness and neatness; 11°. They should demand thought-

[1] From the *Journal of education*, Feb. 1, 1887.

fulness, and thus be more than a purely mechanical work; 12°. They should strengthen and develop the physique; 13°. They should help to exercise the sense of form; 14°. Lastly, as many tools and manipulations as possible should be employed.

Such are the results aimed at; but here a very important question arises, Who is to be the slöjd teacher? Teachers are already so overburdened with work, that it seems too much to expect them to undertake another subject. But for them, too, a subject so novel, and necessarily so differently taught from the ordinary school-subjects, would doubtless have its attractions, and would illustrate the saying, 'Change of work's as good as play.'

Whether this be so or not, the slöjd instruction must be undertaken, not by an artisan, who would naturally regard it merely from its mechanical side, whereas the main object of slöjd is not the teaching of any trade, but the development of the faculties, and the acquiring of general dexterity. It must therefore be given by a trained teacher, who understands the nature of the material on which he has to work, viz., child-nature, and, if possible, by the same teacher who takes the other school-subjects.

I may mention that by means of slöjd, which necessitates individual supervision and instruction, the teacher has an opportunity of obtaining an insight into the character, and of establishing a personal relation between himself and his pupils, which it is almost impossible to obtain by means of class-instruction. Numbers of teachers can bear witness to the truth of this statement. The teacher should lead, direct, and control the work, but should be careful not to put his hand directly to it. In order to be able to follow with advantage the course of instruction, the pupil ought to have reached a point of development usually attained about the age of eleven.

One word as to the main differences between wood-slöjd and ordinary carpentering, with which it is very apt to be confused. These lie, 1°, in the character of the objects made, which are usually smaller than those made in the trade; 2°, in the tools used (the knife, for instance, the most important of all in slöjd, is little used in ordinary carpentry); 3°, in the manner of working (the division of labor employed in the trade is not allowed in slöjd, where each article is begun, carried on, and finished by the same pupil); 4°, but the fundamental difference is in the object of slöjd, which is, not to turn out full-blown, or half-blown, or even quarter-blown young carpenters, but to develop the faculties, and specially to give general dexterity, which will be useful, whatever line of life the pupil may afterwards follow.

As individual instruction is generally required, and as this manual work cannot be taught in class, the same teacher can only superintend a limited number of pupils at the same time. Generally speaking, there should not be more than twelve.

As to the choice of models: 1°. All articles of luxury are to be excluded; 2°. The objects made are to be of use at home; 3°. The children should be able to finish them entirely without help; 4°. The articles should be made of wood only; 5°. No polish should be used; 6°. As little material as possible should be employed; 7°. The children should learn to work both in the harder and softer woods; 8°. Turning and carving should only be sparingly employed; 9°. The models should develop the children's sense of form and beauty, and for these ends the series should include a certain number of modelled objects (for instance, spoons, ladles, and other curved articles), which are to be executed with a free hand, and chiefly by eye; 10°. By means of going through the whole series, the pupils should learn the use of all the more important tools. In the choice of models, care should be taken that each one prepare for the next.

As to classification of models: 1°. The series ought to progress without a break from the easy to the difficult, from the simple to the complex; 2°. There must be a sufficient variety; 3°. Each model must be so placed in the series that the pupil shall be able to carry it out entirely without the direct help of the teacher, by means of what he has already made; 4°. The models should constitute such a series that at each step the pupil may be able to make, not a passable, but a correct work; 5°. In making the first models, only a few tools are to be employed, but as the series is carried out new tools and new manipulations are to be employed; 6°. The knife, as the fundamental tool, is to be the most used in the beginning of the course; 7°. For the first models, rather hard wood should be employed.

At the beginning of the series the models should be capable of speedy execution, and objects which require a considerable time should be gradually reached.

Let us now see whether slöjd, if the foregoing conditions be carried out, may be regarded as a factor in education, whether considered physically, mentally, or morally.

It is essentially a form of work which calls forth every variety of movement, which brings all the muscles into play, and which exercises both sides of the body. It is so arranged that the children can work with the left hand as well as with the right, in sawing, planing, etc. Thus all the

muscles are strengthened, a more harmonious development attained, and there is less fear of their growing crooked There is no reason to dread their becoming left-handed: in more delicate manipulations, the right hand will always remain the better man of the two.

Does slöjd help forward the mental development? Surely work which draws out and exercises energy, perseverance, order, accuracy, and the habit of attention, cannot be said to fail in influencing the mental faculties; and that it should do so by cultivating the practical side of the intelligence, leading the pupils to rely on themselves, to exercise foresight, to be constantly putting two and two together, is specially needed in these days of excessive examinations, when so many of us are suffering from the adoption of ready-made opinions, and the swallowing whole, in greater or smaller boluses, the results of other men's labors.

We want whole men and women, the sum total of whose faculties is developed, who have learned to apply their knowledge, not only in the emergencies, but in the daily occurrences of life; and this readiness — this steadiness of nerve, the ordered control of that wonderful machine the body, the cultivation of the practical side of us — can only come by exercise, and this is given by means of slöjd. Let us also remember that all skilled work, however humble it may appear, is brain-work too: the hand is the servant of the brain. If any one doubt this, let him try to make, from first to last, some complete object, however insignificant, — be it the modelling of a leaf, cube, or even a ball, or the making of a wooden spoon, — and, I answer for it, he will gain a new respect for hand-work, not only from its usefulness, but the skill it requires.

What does slöjd do for the moral training of the child? It implants respect and love for work in general, including the coarser kinds of bodily work. In the fierce competition which exists in all civilized countries (and nowhere fiercer than in our own), which springs in so many cases from the desire to push on to some fancied higher level of life, what a clearing of the moral atmosphere would be effected if the rising generation could be imbued with the feeling, deepening as they grow up into conviction, that it is the *man* who dignifies or degrades the work, — that all labor which proceeds from a worthy motive is of equal worth, and that the right work for each one of us, and consequently the noblest, is the work we can do best!

But this is not all which slöjd effects in the way of moral influence. It tightens and strengthens the bond between school and home. Every thing which the child makes is for home use, is prized there as his own honest work, and as the product of the skill which he is gaining at school. Among the working-classes, the actual use of the things made by the children (besides the wholesome pleasure and pride they call forth) is found to do much, in the countries where slöjd is practised, to reconcile the parents to their children remaining at school even when they are beginning to be of use at home and to be able to earn something. They have tangible proof, in the objects brought home, that their children are learning something which makes them useful and handy, and which will make them readier in future in learning a trade.

I will only mention one other point in which slöjd bears good moral fruit. I mean, it implants in the child a sense of satisfaction in honest work, begun, carried on, and completed by fair means and by his own exertions. In these days of scamped work, of dishonest tricks to be found in all trades and manufactures, what can we say too much in praise of a system which will give our boys and girls a sense of the dignity of work, a scorn and contempt for what is slovenly or tricky? The slöjd system is completely opposed to the modern principle of division of labor, which is no doubt a necessity in the present conditions of life, but which would be disastrous in education, where the aim must be the development of each individual, not the getting through a given quantity of work in the shortest and cheapest way. I feel sure that a boy or girl who, at a period when impressions are most lasting, has had the solid satisfaction of carrying out a piece of work from beginning to end, will not be satisfied, in adult life, with becoming a mere machine for drilling holes, putting on pins' heads, or turning out chair-legs by the hundred, but will, in his leisure hours, vindicate his dignity and skill by doing some work, whether practical or intellectual, worthy of a human being. We must remember, too, that a large part of the distress in bad times is due to the fact, that, if the particular fragment of work which a person is capable of is taken from him, he can do nothing else whereby to earn his bread.

I can only speak in the briefest way of the crying need there is for some such practical training as is given by slöjd. I am not an enthusiast for the particular form of it which I have studied myself at Nääs, and which I have seen at work in the Swedish schools, where I wish I could transport you, so that you might see for yourselves the earnestness and energy of the young workers, the dexterity with which they handle their tools, their extreme carefulness (for no damaged or careless work is passed), and the independent manner in

which they work. But I do say, that we want something of the kind, suited to our national needs and character, and bearing the same fruit of trained intelligence and skill which it is producing in the countries where it is practised. A great deal is being done in England for technical education, and a great deal is said as to its need, for there is a very real danger of English workmen being driven out of the field on account of the superior skill of foreigners and the great advantages they enjoy in the way of technical education. We can but rejoice that we are beginning to recognize this danger, and that so much attention is being directed to the need of technical education; but even supposing the country were covered with technical schools, if our young people come to them with eyes and hands untrained, with little or no sense of form and beauty, with lack of perception and habits of observation, with untrained and undeveloped muscles, how can they possibly hold their own against the youth of other countries, coming fresh from schools where eye and hand have been trained to general dexterity, which will stand them in good stead whatever special branch of technical work they may take up, with trained observation and perception, and with a love for work and an interest in it which has been quickened and stimulated by many a victory gained by perseverance, attention, and energy?

Should this slöjd instruction be given to girls as well as boys? This question has already been answered practically in the affirmative in Sweden, and with excellent results. It is just as important for a woman to have the complete use of her hands as for a man. It may be said that girls have needlework, which is more suited to their sex, and more useful to them in after-life. It would be a very sorry thing for our future wives and mothers not to learn the use of their needle, but why should they not learn needlework and slöjd too? The use of the tools would develop their muscles, and they would gain an added dexterity which needlework alone cannot give. And besides this general development, which is of paramount importance, the positive knowledge gained, and the power of doing little jobs about the house, would be of great service to them when they grow up.

But, it will be objected, even granted that a universal hand-education should be given, including both sexes, and granted that teachers are forthcoming who are capable of giving it, how is it possible to spare time for another subject? I will only reply, that the schools in Sweden are among the best in Europe, and yet they find time for it. The slöjd classes — which are entirely voluntary — are held in the evenings, so as not to interfere with the ordinary school-work.

For the girls of our higher schools it seems to me even more important than for their sisters of the working classes. The latter have to help their mothers at home in many active ways, and get, at all events, plenty of movement and variety of occupation; but the former, who have not so many active games as their brothers, and who are often unable to be much out of doors in bad or severe weather, are lamentably in want of some interesting active work as a counterpoise to the continual sitting and poring over books and exercises. Slöjd of some sort is the very thing they need. I am persuaded, that, if only we set our shoulder to the wheel in this matter, we shall find in this hand-education the true remedy for over-pressure of brain, which is not an invention of the doctors.

You will perhaps wonder where all the teachers of slöjd, so universally taught in the Scandinavian schools, are trained. A slöjd seminary has been founded by Herr Abrahamson, a wealthy Gothenburg merchant, on his beautiful estate of Nääs, within easy reach of Floda station, on the main line between Stockholm and Gothenburg, and about an hour by rail from the latter.

This seminary was founded in memory of Herr Abrahamson's wife, in 1872, and he has spared neither time, money, nor effort in making it a worthy memorial. There is also a model school for boys and girls in connection with it, so that those who are in training may see the system actually at work among the children. I may mention, in passing, that this school has a great reputation, and that children are sent from considerable distances to attend it. The seminary is directed by Herr Otto Salomon (Herr Abrahamson's nephew), who is quite an enthusiast in the cause of slöjd, and devotes his life to the spread of the system in other countries as well as his own, and to the improvement of it in practical details. The seminary, which is built very picturesquely of timber, in the old Norwegian style, is situated in Herr Abrahamson's park, close to the lovely lake of Sävelången. It consists of large work-rooms fitted with double rows of carpenters' benches and racks all round for the different tools, a large lecture-room, a sitting-room for the gentlemen, a small one for the ladies, and a room where the models and finished works are kept. Upstairs is sleeping accommodation for thirty men. In addition to the seminary, there is a pretty little house close by, called 'Vänhem' (friends' home), where the lady students live, who form a very small minority of those who attend the course. There are also other cottages in the neighborhood, where

the overflowing numbers attending the course are accommodated.

There are four slöjd courses given in the course of the year, — two summer and two winter courses. Each course lasts six weeks; and, as the time is so short, the hours are somewhat long, and the work rather hard, for those who are not accustomed to much bodily exercise. The plan of the day is as follows: prayer, 6.45 A.M.; lecture, 7 to 8; breakfast; slöjd from 8.30 to 1, with a break of a quarter of an hour; dinner and rest, 1 to 3; slöjd, 3 to 5; coffee, followed by discussions, either on the slöjd models — which are apt to be very lively — or on ordinary school-subjects, for Herr Salomon is anxious to take advantage of the presence of so many teachers by giving them frequent opportunities of hearing each other's views, and thus rubbing each other up by means of a little wholesome friction.

The whole number of models, consisting of a hundred articles, is divided into two series, — fifty in the first course, and fifty in the second. Many of the teachers return in order to go through the second course, and are sure of a hearty welcome. At the end of the course, each member receives a certificate, in the presence of the whole body, stating that he or she has attended the course, and has made so many models. No special number is required. Every one is anxious to get on; but strength and ability vary considerably, and those who come with a knowledge of carpentering soon leave those who have had no such previous practice hopelessly behind. But all gain much during the course, quite enough to begin a slöjd class on their return to their respective schools, in different parts of the world.

The difficulty of teaching together representatives of so many different nations is not so great as it seems. As far as the practical work is concerned, the chief thing is to be shown how to work, handle the tools, etc., and the primitive language of signs goes a long way. The lectures are more difficult to manage, and I can only say how they were given at the course I attended. A daily lecture was given in Swedish and in German. The former was attended, not only by the Swedes, but by the Danes, Norwegians, and Finlanders, who understand Swedish well. The latter was attended by the Austrians, Bohemians, and English. If we had known no German at all, I believe we should have received some private instruction.

A few words, in conclusion, as to the life at Nääs. I think the thing which, above all, struck us, was its complete novelty. We felt as if we had dropped into another planet. The mixture of nationalities and languages, the simplicity of the mode of life, the early hours, the general kindliness, the absence of all class-distinctions, the child-like enjoyment of little pleasures, the good-tempered rivalry in work, made up a sort of hyperborean Arcadia. On the other hand, it is only fair to say that the general arrangements are so primitive, that no one should go there who cannot put up with a certain amount of roughing it and very simple fare. I may mention here, in case any one should feel inclined to spend the summer holidays in going through a course of slöjd at Nääs, that ten pounds would well cover the whole cost of the undertaking. A first-class return ticket from London to Gothenburg is £5 5s. (this does not include food). The journey to and from Nääs is short and inexpensive, and a very small sum, about 1s. a day, is charged for food. Application should be made some months beforehand to Herr Otto Salomon, Nääs, Floda station, Sweden.

Another pleasure was the excellent singing, generally given in the open air, specially during the long solemn evenings of the north, when the air was alive with song. A choir was formed of the best male voices, under an excellent conductor, a member of the course, who took great pains with them. The quarter of an hour's rest in the morning was often turned to good account in the musical line. We used to sit about outside the seminary, while the choir would stand on a knoll and give us song after song till the bell rang, summoning us to return to our labors. Will you think it strange that this going to school again was also a pleasure? We quite enjoyed to be the pupil instead of the teacher, and were amused to find how much our point of view had changed since we were *in statu pupillari*. But, let me whisper, we should probably not have enjoyed it had it been for more than a very limited time.

We are proud, and justly proud, of our position as Englishmen; but I think we can well afford to recognize more heartily and generously the quota which each civilized nation brings to the intellectual wealth of all. Even those who are small in population, and not so well endowed as ourselves with natural advantages, do their part relatively perhaps better than we; and Swedish education, during this century, has advanced by leaps and bounds. I will only remind you of these three facts: it was a Swede, Captain Nordenskiöld, who, in the little Vega, first made the north-east passage; it was a Swede, Herr Henrik Ling, who has given to the world the most scientific and comprehensive system of gymnastics; and it is Sweden who again comes forward and offers us the hand-education, which, if rightly used, is to give our children a completeness in their training which is at present lacking.

Evelyn Chapman.

### ASPECTS OF EDUCATION.

#### HUMANISM.— II.

HUMANISM, in the hands of Sturm and his followers, was at least intelligible and masculine. Although it was founded upon a narrow basis, its aims were clear and honest. In the next two hundred years, humanistic teaching was to undergo an influence of a very different character, which, maintaining the outward show, changed the substance and turned what was a modified blessing into a decided curse. The Jesuit schools founded in the sixteenth century obtained so much vogue in the seventeenth and eighteenth, that they influenced the whole of European education, Protestant as well as Catholic. They had one title to respect, and one only. They were the first to bring the individual teacher face to face with the individual pupil. Whatever their objects may have been, and whatever were the ends for which they intended to use their influence, there can be no doubt that they did from the first what they still do, — attempt to study the workings of each individual mind and the beat of each single heart. Here their merit ends. They desired that the hearts of their pupils should be devoted to them, and not to humanity, and that their minds should never move out of the limits which they themselves should fix. Humanism lay ready to their hand. Here was a subject on which infinite ingenuity might be expended and endless time wasted. To become a complete master of the style of Cicero, Horace, or Ovid, might take a lifetime; yet the result was showy: few could understand its merit or the processes by which it was reached. To declaim on speech-day a long alcaic ode on the immaculate Virgin, or to turn the Song of Solomon into the language of Ovid's 'Art of love,' was an achievement which all might admire. The Jesuits were the inventors of that bane of humanistic education, the exaggerated reverence paid to Latin verse composition. What can be a worse training for the human mind? A mind is called well trained in language when it can conceive accurately the idea which it wishes to express, and can express that idea in language which no one can misunderstand. The whole theory of original Latin verse composition is opposed to this. The pupil is set to write a copy of verses on a set subject, be it spring or winter, autumn or summer. His notion of what he should say is very hazy, but under pressure he will write down twenty so-called ideas for twenty lines of Latin verse. To expand these he will have resource to his *gradus*, a book which the Jesuits have the credit of inventing. He will there find so-called synonymes of the Latin words he has chosen, which cannot really express the same sense, for in any language very few pairs of words are to be found with precisely the same meaning. If his synonymes are insufficient for the purpose, he will fill up the line with epithets chosen from the *gradus*, not because they are just, or appropriate, or needful, but because they scan. If these are not enough, his handbook will furnish him with phrases of greater length, bearing more or less upon the subject, and even with entire verses which he may introduce, so far as he can do so without fear of detection. To spend much time on this process is to play and juggle with the human mind, to make pretence at thought when there is no thought at all, to mark time instead of marching, to work a treadmill that grinds no corn, to weave a web which must be perpetually unravelled; yet in the latter half of the eighteenth century we see original Latin verses the chosen task of school-boys and a too frequent pastime for statesmen.

Let us not condemn all composition in dead languages. To turn the masterpieces of modern poetry into an exact Greek or Latin equivalent may be the worthy occupation of the best trained scholars. It has more than once happened that the copy has been more poetical, more musical, more worthy, than the original itself. Nor is imitation of any literature which we are studying to be despised. The Italian sonnets of Arthur Hallam, the French lyrics of Swinburne, if not genuine poetry, are at least precious fruits of the poetical mind. But if these fruits are to be produced at all, it is necessary that they should be produced without compulsion. Train your scholar in the best examples of Greek and Latin, let him study Virgil, Homer, and the Greek tragedians night and day, show him all the poetry they contain, let him compare them with the best productions of his native tongue, and the probability is, that, if he has any creative faculty, he will begin to imitate and will write Greek and Latin verses without coercion. But set him down on a form with fifty other boys, and bid him write poetry on a subject for which he does not care, in a language which he does not understand and which is often unfitted to the thoughts which he has to express, guide him by mechanical rules, and assist him with mechanical handbooks; you will then find that what ought to have been a pleasure has been a barren toil, and that his mind is dulled by the effort. Even at the present day, after all that has been written against Latin verses by those who are most fit to judge, they hold an inordinate place in English classical education, and give us good reason to pass the strongest condemnation on the sect which introduced them.

The falseness of Jesuit principles of education

goes further than this. They can best be judged on the great annual festival when the parents are invited to see the triumphs of their children. Speeches in different languages are delivered by children of various ages, often with a pathos that draws tears from those who hear them: this is a good part of their training. The head boy reads out the list of those who have gained prizes. After reciting a string of names, he suddenly pauses, thus attracting the attention of all present. The prefect of studies, who stands behind him, comes to his rescue, and utters the boy's own name, which he has been too modest to pronounce himself. Had he repeated it among the others, it would have attracted no attention, but the modesty which avoided the appearance of self-laudation was used to extort the applause of the multitude.

The boys are examined *viva voce*. Nothing can be more fair. Any one at random is asked to take a Virgil or Sophocles, to submit any passage for translation, and to ask any questions he pleases. If the examiner does his work honestly, he soon finds what a mistake he has made. He submits a passage for translation. The boy makes a mistake; the examiner stops him. The boy blunders; the examiner insists upon a correct translation, which takes a long time in coming. There is general discomfort and confusion. The whole sympathy of the audience is with the good-looking ingenuous youth on the platform, and not with the bald-headed pedant who is examining him. The examiner asks a question; the boy answers it wrong. As often as the examiner rejects the answer given to him, so often does the impatience of the audience arise against the stupid man who does not know how to ask questions that the boys can answer.

If the Jesuits had no faults of their own, they at least deserve the condemnation of posterity for suppressing their rivals the Jansenists, who offered to France the best opportunity of receiving a humanistic education devoted to the noblest ends. The object of the distinguished men who founded the little schools of Port Royal was exactly the opposite to that of their Jesuit rivals. They desired to make the moral character of their pupils strong and independent, and to train their intellects from the first in the severe studies of close and logical reasoning. In the individual attention they gave to their pupils, they were superior even to the Jesuits. The whole number of children that passed through their schools was small; and no teacher was allowed to have charge of more than five or six, while the masters were thus able to study the characters and capacities of their pupils in the minutest details. Pains were always taken to avoid undue familiarity. Between the pupils themselves, as between their professors, there was to reign a dignified and temperate courtesy, removed equally from sickly sentimentality and from rough and boisterous good-fellowship. The grammar of Port Royal was not a collection of rules to be learned by heart, but a treatise on logic, which forms the basis of all grammar. Where rules or examples had, of necessity, to be learned, they were, in disregard of precedent, placed in such a form as to be most easily remembered. The Jansenists were guilty of another innovation which gave a great handle to their opponents. They taught the dead languages of antiquity from the living tongue of their own France. What impiety, said the Jesuits, thus to vulgarize studies which ought never to be presented to us without solemn and even sacred associations! We hear little or nothing in the Port Royal schools of the cultivation of Latin verses. The air which they breathed was too bracing for that trivial exercise. On the other hand, they did great service to the study of Greek. It is true that the Jesuits maintained Greek as a prominent study in their schools, which the University of Paris had been compelled to surrender by the clamor of parents. Yet the 'Garden of Greek roots,' an attempt to popularize the study by imparting the most necessary knowledge of Greek in French verses, remained for a long time a standard school-book, and was used for that purpose by so careful and exact a scholar as the historian Gibbon. If the Jansenist schools had been suffered to exist, they might have profoundly affected not only the course of study in France, but the minds and characters of Frenchmen. European nations, in following the French models of excellence which reigned without dispute before the French revolution, might have had a more masculine type held up for their admiration. This, however, was not to be; and French literature, impregnated with Ciceronianism, had been but slightly touched with the chastening influences of Hellenic studies or of logical precision.

Humanism has undergone many changes in the last generation, and it is difficult to forecast its future. The position which it held in education after the revival of learning was due to two opinions about it, which were believed very generally, but not always very consistently. On the one hand, it was thought to be the best gymnastic for the mind, the best mechanical exercise which the human faculties could be put through. On the other hand, the literatures of Greece and Rome, which were the subject-matter of humanism, were regarded as absolutely the things best worth study, not only from their intrinsic merit,

but from their forming the best introduction to all modern studies. Not many years ago modern geography was taught in the most distinguished of English schools by what was called a comparative atlas and a comparative geography-book. Ancient geography was taught first as the thing most needful, and modern names were only dealt with as the correlatives of ancient ones. A good English style was supposed to be acquired from the study of classics. Latin verses formed the best introduction to English poetry; Latin themes were the best method of learning all general information. Even now at our universities many people would maintain that the science of modern statesmanship could not be better learned than from Aristotle's 'Politics.' Both these points of view have suffered rude shocks. Undoubtedly from considerations which were indicated above, Greek and Latin, and Greek especially, do form an admirable training for the mind. Latin grammar is more precise, more logical, and in these respects harder, than the grammars of modern languages. The Greeks were probably the most gifted people who ever lived, and their language was adapted in a wonderful manner to express most perfectly their most subtle thoughts. To a mature scholar, who recognizes every shade of his meaning, Thucydides will appear untranslatable. The words as he puts them down, whether grammatical or not, express precisely what he intends to say, with a vividness and a directness which cannot be surpassed. To express all that he would tell us in English would require long clumsy paraphrases, and even these would not express it altogether. The effort made by a modern mind to follow in its subtlest folds every sinuosity of the thought of Plato or Aristotle is in itself a very valuable training; but to profit by this training, a considerable standard in the languages must have been reached, and as years go on, the number who reach this standard is fewer and fewer. The foundations have been undermined, boys and parents avoid the trouble of learning dead languages, and teachers are ready to escape the trouble of teaching them. The result is, that only the chosen minority are in the position of profiting by a training which was once universal; and these have such distinguished and apprehensive intellects that they would almost always make a training for themselves.

If humanism has suffered by the growth of a disbelief in its powers as a gymnastic, there is no sign that its intrinsic worth is rated less highly than it was. Indeed, as we begin to appreciate more exactly the necessary elements of culture, our respect for humanism grows greater. We are told that there are two great elements in modern civilization, — Hebraism and Hellenism. There is no fear at present that the first will not be well looked after. No Christian country is without an efficient church establishment; and the training of the clergy in all their several degrees, who are the chosen guardians of Hebraism, is more extensive and more satisfactory than in previous generations. Take away Hebraism, and the most valuable part of our intellectual furniture which remains is Hellenism. That can only be preserved by the combined efforts of all those who are indebted to it, and who have learned its value. This is the special function of schools and universities. It is remarkable that each attack made on the study of Greek has produced some new effort to make the study of Hellenism more general. The establishment of the English Hellenic society was the direct result of an attempt to exclude Greek from the entrance examinations of the university. The growth of science has been coincident with the revival of acted Greek plays, both in England and America. The dead languages which were once reverenced as a training are now valued for what they can teach us: and scholarship is defined, not as the art of interchanging in the most ingenious manner the idioms of the Greek, Latin, and English languages, but as the calling-back to life of the Hellenic world in all its branches. Hellenism need not always mean the study of Greek life and thought. Egyptian culture preceded Hellenic culture. The Greeks went to study in the schools of Egypt, as the Romans frequented the universities of Greece, and as the English visit those of Germany. As the learning of the Egyptians, whatever it may have been, has been absorbed for our purposes partly by Hellenism and partly by Hebraism, so Hellenism itself may be absorbed, so far as it deserves to be, by modern literature. One who knew Milton by heart would be no poor Hebraist, and he who possessed the whole of Goethe would be no mean Hellenist. But this time has not yet arrived. If humanism suffers now from a slight obscuration, due to its unfortunate attempt to claim too much mastery over the human mind; yet there is no fear of its being materially obscured, and the assistance which it may yet render the human race, in her search after the good, the beautiful, and the true, should command the sympathy, and stimulate the efforts, of every man to whom those objects are dear.

OSCAR BROWNING.

## *SCHOOLS IN EGYPT.*

THE report of the minister of public instruction for 1875 shows a total of 4,817 schools in Egypt, with 6,045 teachers and 140,977 students. Of these, 4,685 schools and 3 so-called universities

having, in all, 5,307 teachers and 127,138 students, were purely Arabic; 93 schools, with 416 teachers and 8,961 pupils, were sustained by the various foreign colonies and religious communities; the remainder being under governmental control. Statistics since 1875 are in great part not obtainable; but it may be safely said, that, during the past twelve years, almost no change has taken place in the Arabic schools, while the other two classes have made great progress.

The native education is, for practical purposes, valueless, as it consists in mere memorizing, the other faculties being entirely neglected, of which the outcome is a mechanical acquaintance with a list of facts; and even that is lost when the formulaic order is destroyed. At almost every street-corner in the cities, behind a fountain, is a native school, presided over by a sheikh, who instructs from ten to one hundred boys in committing the Koran to memory. In 1875 these schools were attended by 112,000 children. The instruction consists in repeating over and over again a single verse, until the pupil has learned it. The droning of the children is always accompanied with a swinging motion of the body, which is supposed to facilitate the mental effort.

The university course is much the same as that of the elementary schools, the Koran being the centre and end of all instruction. At Cairo is the University El Azhar, the most celebrated stronghold of Mohammedan doctrine. Its students number seven or eight thousand, and come from all Mohammedan countries. The studies are the memorizing of the Koran and of the commentaries, grammar, language, and law (but only so far as they are interwoven with the faith), and a smattering of Aristotelian philosophy. No time is devoted to mathematics; history and geography are despised, and every foreign language is rigorously excluded as dangerous to the religion of the faithful. Students sometimes spend a number of years at the school, and at the end of the time are fitted for nothing more than to become caliphs or teachers of Arabic in foreign schools, at a salary of one or two pounds a month.

The schools managed by foreigners, especially those of the American and English missions, are European in organization, and are accomplishing some excellent results. In them much time is devoted to the study of English and French, a knowledge of which is of increasing value and importance in Egypt. These schools are attended by pupils of all nationalities and religions, and many of them are open to both sexes.

Government supervision of schools has existed for forty years: but until lately the system was overrun with abuses, and barren of results. During the last two years a new *régime* has been entered upon, and the government schools now offer excellent advantages. They are of three classes,—primary, preparatory, and higher special schools. The primary schools, for children from eight to twelve years of age, throughout the four-years' course give instruction in the Koran, Arabic language and penmanship, arithmetic, and object-lessons of the kindergarten character. To these studies are added, after the first year, drawing and the geography of the Ottoman empire; after the second year, French, English, geometry, and Egyptian history. Under the head of *civilité et éducation*, the pupils are taught the principles of politeness, cleanliness, moral habits, and so forth. The object-lessons give elementary instruction in physics, mechanics, and in various industries. The preparatory schools continue the same courses, adding, in the first year, physics, chemistry, natural history, algebra, and moral philosophy. The results obtained from these schools is encouraging, though the incompetence of Arab teachers to adopt modern methods is a great drawback. A ministerial decree of 1886 founded a normal school at Cairo "to train professors for the schools of Egypt, and to popularize good methods of instruction." In the normal school the course of three years is a continuance of those of the two lower grades of schools, with the addition of instruction in hygiene, psychology, pedagogy, and gymnastics. Small scholarships are offered to the most deserving students.

Among the other special courses are schools of medicine and law, two good schools of technology, and a school of languages. Much good work is being done, especially in the departments of modern languages, a knowledge of which is necessary to obtain a government position. Much remains to be done, but the energetic efforts of the government have fixed a standard of thoroughness in education which must soon result in a higher degree of intelligence and less of mechanical knowledge among the people. R. ARROWSMITH.

## *DOES EDUCATION DIMINISH INDUSTRY?*

THE London *Spectator*, at once the most serious and dignified of papers, recently published an article of which the above is the title, which took for the subject of its comments the plan now being advocated in England for introducing workshops into the national schools. As the same plan is coming into prominence in this country, the *Spectator's* remarks will interest our readers. The writer in question says that many critics of the present system of primary instruction in England fear that it will breed up a generation with a

distaste, and even contempt, for manual labor. "The boys make less trusty workmen, and the girls worse cooks and housemaids and laundry-women." They "are less handy and more conceited than a former generation; have less liking for work, and more 'notions.'" As this language is used in advocating a specific project, it is perhaps too strong to be critical; but there is no doubt it expresses a feeling very general not only with 'the classes,' but with employers of labor of all degrees, and especially with employers in a small way. Moreover, behind all these complaints, some of which are justified, for the English have as yet been too busy making up leeway in the battle with utter ignorance to attend sufficiently to technical education, there rests an idea general enough and broad enough to deserve attention, — the idea that education is in itself inimical to continuous industry. A lad who expends some years in acquiring knowledge will not, it is fancied, betake himself willingly to the drudgery of manual labor, will avoid it, even if he loses by the avoidance, will crowd into the towns, and will go perilously near starvation in any easy employment, rather than work with his hands for fifty-four hours a week. The old method of training lads through apprenticeship to the necessary habit of endurance is breaking up, and with it the mechanical aptitude transmitted through generations which made the acquisition of the necessary knowledge almost unconscious. The working lad's mind has expanded, however little; and he will not, it is contended, work as he did. It is quite right that the subject should be stirred, for, if the theory of the objectors is true, the look-out for the world is but a poor one. Some of the most necessary tasks are disagreeable tasks. Somebody must cart the muck, dig the drains, unload the ships, stack the coals, carry the bricks, or the world will stop; and a resort to slave-labor would be criminal, or to excessive pay highly inconvenient or impossible. Machinery will not do every thing; will not, for instance, before making the bricks, excavate and damp the clay for filling the moulds. The human hand is still, in many departments of labor, the only conceivable as well as the only available machine. Education cannot be stopped: and if, therefore, education develops an aversion to hard work, humanity will stand in presence of a nearly insoluble problem. The chance even is serious, and attracts the more attention because there is some *prima-facie* evidence that the danger is real. One clever race, the Jew, which, though often uneducated, has just the kind of intellect that education by itself produces, steadily and successfully avoids hard manual labor. The Hebrews all over the earth will not plough, yet they contrive to live. Another, the Yankee, which is educated, dislikes work so much that it is said that its true destiny is to oversee workers, and that a Yankee sitting on the gate to drive other men to labor is worth five Yankees in a field. The drift towards the towns, which in all countries follows education, and is now covering Europe with huge centres of population, is believed to be in part caused by the hope of obtaining 'light' tasks; and the excessive increase of competitors for clerkships has been for years matter of constant observation. The clerks swarm in ever-increasing numbers, till their wages are driven down to starvation-point, and they declare themselves incapable of living under a competition which seems to have no bounds. There are trades, we believe, now, in which the clerks pay the employers. Some of the peoples of the continent are penetrated with the notion that instruction is fatal to willing labor. Mr. Hamerton, in his wise book on France, declares that the peasants think a son who has gone to school outside the village is lost to their work, and believes that in the main they are right, the lads who have been instructed revolting against the unbroken toil, the penury, the calculating thrift, essential to the peasant life. English dealers of the lower class say a lad must be taken young, or he will never succeed; and in one trade at least, that of a sailor, the rules in favor of beginning early are made immutable, the old hands knowing from experience that the life is intolerable to most of those who have tried any other.

On the other hand, no dislike of work, and especially no dislike of agricultural work, which is at once the roughest, the most continuous, and the worst paid, has appeared among two of the best-educated races. The Scotch, who have been taught for two hundred years, and are now far more thoroughly trained than the English national-school boys, show no disposition to avoid labor, but are, on the contrary, remarkable for persistent and fairly contented industry. There are thousands of Hugh Millers among them, though without his genius. The Prussian peasants, who are as educated as the English will be twenty years hence, work exceedingly hard, and in the country, where their holdings are their own, show none of the resentment at their fate which is no doubt manifested in the towns in the form of socialist aspirations. Gardeners, who all over Great Britain are the best instructed of manual laborers, work, more especially when working for themselves, with unusual diligence; and it is matter of constant observation that a laborer who happens by any accident to be a 'bit of a scholar' can be depended upon when work presses and every

man is required. The people of Rome, who can read and write, are far more diligent than the Neapolitans, who cannot; and the best workmen in Italy are those who have passed through the army, and so obtained what is practically an education. There seems no *a priori* reason why it should be otherwise. Attendance in the schools, which are well ventilated and warm, notoriously improves health, and there is no evidence whatever that it diminishes strength in the lower class any more than in the upper, who decidedly benefit by school-life. Nothing recognizable, in fact, happens to the child who is taught, except a break in his habit of steady endurance, which is met in the agricultural schools by the system of half-time, and does not appear to impair industry in factories or workshops. Cultivated lads — we mean lads 'well educated' in the conventional sense — work in scores in the founderies, learning the engineer's business through a most severe physical apprenticeship; and lads who emigrate without capital constantly work at hard tasks as well and as steadily as ploughmen; often, moreover, acknowledging a complete contentment with their toil. They feel monotony when there is monotony; but they do not resent hand-work any more than thousands of educated Canadian or New England farmers. On the whole, and subject to the evidence which can only be supplied by many more years of observation, we should say the truth was something of this kind. Education of the modern kind does not diminish industry, and does not, except for a very short period, break the habit of assiduity at work. Nor does it diminish the readiness to do manual labor in those who can do it, though it does diminish their number, — the 'delicate' lads, as their mothers call them, who, if left uneducated, would have gone on in the groove of their forefathers, taking by a species of natural selection to the lighter tasks. The remainder work as before, though probably not in the old, machine-like way. They spare themselves more, are more quick to avoid unnecessary toil, and no doubt, as a large proportion are and must be selfish men, in numberless instances they 'scamp' their work in ways the unintelligent never think of. That scamping, together with the eagerness for more money produced by new wants, and a certain indocility or independence, combine to produce an unfavorable impression as to industry which is not justified, or rather is due to other causes than aversion to work. The English must wait a little for full information, the boys who have passed through school not being thirty yet; but they do not despair of seeing plenty of Hugh Millers among their workmen; that is, men who are educated, yet have a definite love for and pride in exceedingly hard and monotonous manual toil. Miller set up stone walls for eight hours a day, — a real back-breaking occupation, — but he had learned more than most lads. It would be well if half-time could be made general, as many are nearly convinced it would increase learning, by allowing school-time to last longer, and would not discourage any scheme for keeping up the habit of manual labor, which will be the lot of the great majority while the world goes round, and which is, in fact, the permanent gymnasium of the human race; but there is little fear, even if the present system continues. The changes which may come will not be produced by laziness, but by a longing for larger wages, and the comfort they bring, which some industries, agricultural especially, in closely populated countries, may find it difficult to satisfy. It will be satisfied, however, in one way or another, for education opens wide the grand safety-valve, the power of wandering over earth in search of the opportunity of toil. For what we know, the human race may be destined some day to perish like mites on a cheese, through their own multiplication; but at present there is ample space for all of our race, who may for the next century, at the cost only of expatriation, have their twenty acres apiece to work on. Germans, Englishmen, Italians, are swarming out in thousands daily; but still there is no chance that they will perish for want of room, or be driven, like Chinamen, to that ceaseless work for bare existence under which other virtues than industry are apt to perish. Another Europe could live and prosper on the unpeopled river-basins of South America. Education helps to disperse mankind; and we certainly do not find that emigrants, who are rarely of the know-nothing class, are at all reluctant to undertake severe toil. Is there not in the whole discussion a defect caused by tradition, an impression that as brain-workers avoid hard labor, knowing well that they cannot do both up to their full power, those whose brains have been developed will never do it? Fortunately, or unfortunately, they will specially feel the great disciplining force of the world, 'the strong conscription of hunger,' which constrains us all. If all the world were Newtons, nobody would get a mouthful of bread without somebody facing all weathers to plough and sow and reap.

## *THE IMPERIAL UNIVERSITY OF JAPAN.*

To those of us who are not intimately acquainted with the intellectual progress made by Japan in recent years, the calendar of the Imperial university for 1886 will come as a revelation.

It is handsomely printed in the English language, and presents very many points of interest.

We learn from it that the Teikoku Daigaku, or Imperial university, was organized March 1, 1886, by an imperial ordinance. The former Tōkyō university and the college of engineering are merged in the present institution. The university is under the control of the minister of state for education, and depends for its revenue on annual allowances from the treasury of the imperial government. The offices of the university, the library, the colleges of law, medicine, literature, and science, the hospital attached to the college of medicine, and the dormitories of these four colleges, — all the university, in fact, except the college of engineering, which has its temporary location elsewhere, — are situated on extensive grounds near Tōkyō. In the ordinance founding the university, its object is declared to be "the teaching of such arts and sciences as are required for the purposes of the state, and the prosecution of original investigations in such arts and sciences." The president of the university is assisted by a board of councillors, who have charge of the curricula of studies and the promotion of the interests of the university and those of each college. These councillors are selected from the professors by the minister of education, each college being entitled to two. Their term of service is five years. Each college has a director or dean chosen from its professors. The academic year extends, as is usual with us, from September until June, and consists of three terms. Admission to the first-year class is only granted to such students as have completed the course in one of the high middle schools, or can pass an examination instituted by the university authorities. The marking system is in force, and elaborate rules for its regulation are given. There is also a system of elective studies, and a large number of scholarships are provided for deserving and needy students.

In connection with the medical college, a hospital is provided for the admission of such patients as may be deemed instructive cases in medical and surgical practice and investigation. The hospital contains five wards and two hundred and sixteen beds in all. Scientific investigations into the nature of 'kakke,' an endemic disease peculiar to Japan, are carried on here continually. The library — which contains 180,000 volumes — and museums are extensive and well arranged, and there is a special observatory for the study of earthquake phenomena. The general results of these observations are published from time to time in English and Japanese. There is also a botanic garden and a marine biological laboratory.

The university has now 540 students, of whom 183 are law students, 204 medical, 81 in the college of engineering, 23 in the college of literature, and 30 in the college of science. The curriculum is surprisingly comprehensive, and the announcements of courses closely resemble those of a German university. The corps of professors and lecturers includes a number of Europeans and Americans, as well as many natives who have obtained degrees either in this country or in Europe. Among the universities and colleges represented by graduates on the faculty are those of Berlin, Paris, London, Strasburg, Leipzig, Erlangen, Heidelberg, Dublin, Göttingen, Freiberg, Glasgow, St. Andrews, Edinburgh, and Munich in Europe, and Columbia, Yale, Harvard, Johns Hopkins, Michigan, Cornell, Hamilton, Amherst, and Stevens institute in this country.

## *ALEXANDER'S PROBLEMS OF PHILOSOPHY.*

So much of the philosophical writing of the day is either barren repetition or empty rhetoric, that it is something of a surprise to find a book on pure philosophy, written by a man who not only has a definite end in view, but who knows what that end is; and who, to reach that end, has not found it necessary to get together a laborious treatise on the human mind or a huge encyclopaedia of ethical science. In one hundred and seventy pages, Professor Alexander has given us a little work of real timeliness and value. For clearness and profundity of thought, deftness of presentation, and lucidity of style, Professor Alexander's book is not surpassed by any philosophical work of similar scope in the language. We are gratified to miss in it cumbrous terminologies, involved sentences, and inapposite illustrations. It is so simple, frank, and straightforward, that it will appeal to a large class of thoughtful men who are accustomed to sneer at philosophy and its devotees.

The various chapters are themselves so tersely worded, that any summary of them that would be just and at the same time much shorter than the chapters themselves, is impossible.

The opening chapter, 'The difficulties of philosophy,' strikes the keynote of the book. The author shows that many so-called philosophical difficulties are not difficulties at all, but simple fictions, originated by ignorant or superficial persons, who set them forth 'as lightly as they tell an after-dinner story.' Professor Alexander very justly refuses to spend his time in criticising such

*Some problems of philosophy.* By ARCHIBALD ALEXANDER, Ph.D. New York, Scribner. 16°.

views, and remarks that "a man who has not learned the alphabet is usually deficient in a knowledge of grammar. A surgeon who does not know anatomy is not likely to inspire confidence. The philosophical dilettante who plunges into the solution of problems of great importance without scientific preparation may be left to the task of 'drawing out leviathan with a hook,' and one need not be disturbed if his unsuccessful efforts lead him to the conclusion that 'metaphysics' is obscure, useless, and irreligious." The author then takes up the three ways of viewing metaphysical questions, — the sceptical, the dogmatic, and the critical, — describes each, and implicitly accepts for himself the latter method and the stand-point of Kant. In fact, Professor Alexander's thought is interesting as illustrating a 'return to Kant' which does not necessarily imply a return to Hegel.

In the seventeen brief chapters which follow, the author formulates according to the critical method some of the most important philosophical difficulties as they appear to him. He does not do this with the intention of prejudicing any particular answer to each, but rather, we suspect, to show that "a year's study of a text-book of mental philosophy is *not* all that is necessary to put a man *en rapport* with the state of thought in the present." Professor Alexander's use of the formal logic is excellent, and serves to show what a formidable weapon that much-decried science may become in the hands of an experienced craftsman. In no instance, although disjunctions, dilemmas, syllogisms, and enthymemes occur on almost every page, have we come upon any logical slip or fallacy, though unquestionably specific points in the various arguments may be disputed on psychological or metaphysical grounds.

As an example of the author's method, we quote the conclusion (p. 38) of his chapter on 'The problem of the ultimate nature of matter:' "It is impossible, so far as we know, to separate the fact of force and the fact of causality. One is not found without the other. Wherever there is an effect, there is a manifestation of force. Wherever there is a cause, there is an exercise of force. When, therefore, we attempt to explain matter by referring to force, we are obliged to explain force by referring to causality; and in explaining causality we cannot refer to material phenomena, but are obliged to fall back on the *a priori* law of causality, which is not given by experience."

On the question of the place of physiological psychology, the author speaks plainly, and, it seems to us, with sound common sense. He remarks (p. 63) that "there are two common mistakes, — one, the denunciation of physiological methods by men who have never seen a ganglion-cell; the other, the denunciation of subjective methods by men who have never given an hour to introspection. It does not appear to be necessary, however, that a knowledge of one set of facts should be incompatible with knowledge of the other set. A combination of the two is the ideal psychology."

It is interesting to find Professor Alexander proving (pp. 64, 65) that "it is possible that it is rational to accept what is irrational because it is more rational to trust the authority for what is thought to be irrational than to place our own reason above such an authority." The admission of this conclusion into the arena of scientific debate would be an effectual blow to those self-sufficient investigators who find as many criteria of truth as there are minds.

We should be glad to point out several other portions of this book that we conceive to be the most interesting, but lack of space forbids this. On the argument by which the author tries to show the atheistic meaning of pantheism (p. 121), however, two points of possible criticism suggest themselves. In showing, that, if a plurality of principles is admitted, pantheism, which admits but one principle, falls, Professor Alexander says, "The existence of human persons with conflicting purposes cannot be explained without asserting (on the pantheistic hypothesis, of course) that there is opposition between the parts of God, i.e., a plurality of principles." Would not the same argument prove that the human *ego* is plural? For we certainly find conflicting motives and principles in our own minds. Again, may not the opposition spoken of be only apparent, and the result of our insufficient insight or lack of knowledge? May it not be a part of a real and higher harmony of which our limited faculties are not cognizant?

At the conclusion of the same argument (p. 122), Professor Alexander, having already shown, that, if the pantheistic God is either material or ideal, atheism is the logical consequence, adds, "If the universe, i.e., God, is both material and ideal, then, in so far as God is material, the objection urged as to materialistic pantheism is applicable; and in so far as God is ideal, the objection urged against idealistic pantheism is applicable." Is this treatment by partition valid? Is it possible to separate a compound, and reason about its various constituents as separate entities or qualities, and not as parts of another and more complex whole? It seems to us not. We cannot say that water, in so far as it is oxygen, will do thus and so, and, in so far as it is hydrogen, will do something else. Water is a new compound, and it develops new properties as water, which are not

represented by adding together the properties of oxygen and hydrogen. Suppose, then, that the assumed combination of material and ideal in God give a new set of properties: are they given recognition in this treatment by partition? We are not impugning in any way Professor Alexander's conclusion, but simply stating some objections that have occurred to us as to his method of reaching it.

The concluding chapter, on the 'Doctrine of cause and effect,' is both the longest and most finished in the book. It is a concise and admirable summary of the historical aspect of the doctrine of causation from the pre-Socratic philosophers to Mill and Spencer, and a profoundly suggestive indication of the true theory of cause and effect. All of Professor Alexander's work is thoroughly well done, and we regret to see that not a few typographical errors have crept into an otherwise model piece of book-making. We trust that the book will have a wide circulation, for it will be found an excellent mental tonic as well as an emphatic protest against the philosophical dilettantism now so current. N. M. B.

## *A NEW EDITION OF JUVENAL.*

An edition of Juvenal that should be sufficiently practical for the college class-room, while embodying the latest results of classical research and criticism, has for several years been greatly needed. It is therefore with interest that one turns to the present work in the hope of finding a happy medium between the too fine-spun commentary of Simcox and the too rudimentary treatment adopted by Hardy.

Apart from the typography, the book is a disappointment. The notes contain nothing whatever that is new, being too evidently condensed and simplified from Mayor, and are so desultory and ill-assorted as not even to deserve credit for judicious selection and arrangement. Moreover, real difficulties, both of syntax and exegesis, are passed over, while an inordinate amount of space is given to the elucidation of matters that ought to be familiar to any intelligent school-boy. How meagre are the grammatical notes, may be seen from the fact that on the 171 lines of the first satire there are but two; on the 322 lines of the seventh, with its fourteen pages of commentary, there are but two; and on the 365 lines of the tenth there is only one. When the editors do venture to elucidate some syntactical peculiarity, it is always one that would seem to need no comment whatsoever: as, for instance, the vivid use of the imperfect subjunctive in vii. 69, 70; or the by no means extraordinary employment of the indicative in x. 123; while peculiarities like the metrical *quis* in xii. 48, and the implied *ut* from *ne* in xvi. 9, are still untouched. But, on the other hand, there is a superabundance of commentary like the following on xvi. 14: — "*Grandes magna ad subsellia*: the bench had to be ponderous to support its huge occupant."

An important feature of this edition is the professedly idiomatic translations sprinkled through every page. These are not intended to be paraphrases, for they are enclosed in quotation-marks; and, besides, a paraphrase is elsewhere prefixed to each satire. One instance of this extraordinary rendering will probably suffice. Satire vii. 36 is *translated*, "Now hear the rich man's tricks. To avoid subscribing to you, he poses as a fellow-poet, and trusts to the maxim that 'dog does not eat dog.'"

The editors have very commendably refrained from the absurd expurgation that disfigures so many college editions of Juvenal. Excessive expurgation only excites prurient curiosity; while it so emasculates the author as to make it quite impossible for the reader to claim any real acquaintance with Juvenal as he is, or to understand the bitterness and the motive of his *saeva indignatio*, from the perusal of these fragments of the scattered poet.

The introductions, the summary of a paper by Professor Nettleship, and a brief account of the Codex Pithoeanus, are interesting; but why discuss the Codex Pithoeanus in a work of so elementary a character as this last edition of Rome's greatest satirist? H. T. PECK.

*Thirteen satires of Juvenal: with introduction and notes.* By C. H. PEARSON, M.A., and HERBERT A. STRONG, M.A., LL.D. Oxford, Clarendon pr. 12°.

## *EDWARDS'S DIFFERENTIAL CALCULUS.*

A NEW text-book on the differential calculus comes from the press of Macmillan & Co. It resembles, in size and appearance, the well-known works of Todhunter and Williamson. An exceedingly satisfactory introductory treatment is secured by a close adherence to one point of view, that of limiting ratios. The symbols $dy$ and $dx$ are not used apart, nor the meaning of such a use explained, until the formulas of partial differentiation in chapter vi. prevent any further postponement. In this way, however, there is lost the advantage of exhibiting the variety of original conception and breadth of foundation distinguishing this branch of mathematics, — an advantage,

*Differential calculus, with applications and numerous examples.* By JOSEPH EDWARDS, M.A. New York, Macmillan. 8°.

indeed, much more frequently sought than obtained. The language is plain, and the geometrical illustrations are numerous and good. The serious faults of the book are sins of omission. We look in vain for the customary chapter on the change of the independent variable, and we find a strange limitation in the treatment of the important subject, 'maxima and minima.' The author here contents himself with the discussion of functions of a single variable. The use of symbolic methods, involving the extension of the mathematical laws for the combination of quantity to the symbols of operation, is necessary in the modern differential calculus. In this work the principle introduced is explained in an excellent manner, but a fuller exemplification of its legitimate outgrowth is desirable. More illustrations should be given, especially of the symbolic method of extending Taylor's formula to several variables. The chief strength of the book lies in the chapters relating to the theory of plane curves. In not a few cases we find greater detail and thoroughness than in the corresponding chapters of its predecessors. On the whole, while no decided novelty of treatment is shown to those acquainted with the best works hitherto published, the production is a creditable, useful treatise, without other faults than those mentioned above.

THOMAS S. FISKE.

## THE ALKALI LANDS OF CALIFORNIA.

THE term 'alkali soil' is used in California, and the western states generally, to denote any soil which contains an unusual amount of soluble salts, particularly when they render their presence manifest by an efflorescence on the surface. These salts may be simply an excessive amount of the neutral salts found in minute amounts in all soils, or, in those soils more properly designated as alkaline, they may consist in part of carbonate of soda.

By the natural processes of evaporation at the surface and capillary rise from below, these salts tend to accumulate near or at the surface, thus producing the efflorescence above noted, and also destroying or injuring the crop by their corrosive action on the root-crown.

In the actually alkaline soils, i.e., in those containing carbonate of soda, another injurious effect is also observed. The alkali prevents what is known as the 'flocculation' of the clay contained in the soil; that is, it keeps in the finely divided condition seen in 'puddled' clay. Such a soil can never be brought into proper tilth; even the most thorough cultivation only succeeds in breaking it up into larger or smaller clods, and leaves it in a condition entirely unsuited for the growth of crops.

These alkali soils are somewhat abundant in California, notably in the otherwise extremely fertile San Joaquin valley; and the characteristics outlined above have been tolerably familiar for years. It was not, however, until it was discovered that the process of irrigation, so essential in the dry climate of that region, was serving to extend the area of these alkali soils, and even developing them where they did not exist before, that the magnitude of the problem which they present was generally appreciated.

The pamphlet under review is a summary of investigations carried out at different times at the College of agriculture of the University of California, and in connection with the U. S. census of 1880 by Prof. E. W. Hilgard, than whom there is probably no one more eminently qualified to deal with the question scientifically and practically.

According to Professor Hilgard, the immediate source of the alkali is usually to be found in the soil-water, though it would appear, that, in some cases at least, the lower strata of the soil itself may contain either these salts or compounds which readily yield them by weathering. When reached by digging, the soil-water is not necessarily perceptibly salty or alkaline; but as it evaporates at the surface, and is supplied from below, the soluble salts are concentrated in a very shallow layer at the surface, the solution becoming strong enough to kill crops, or even depositing the solid 'alkali.'

It is thus evident that the most important factor in determining the amount of alkali which accumulates at or near the surface of the soil is the amount of soil-water brought up from below by capillary action and evaporated; and any thing which increases the evaporation will tend to increase the amount of 'alkali' deposited, and to make its presence perceptible in spots where before it was not present, or present in such minute amounts as to produce no harmful effects. This, irrigation, as ordinarily practised, does. If the irrigation-water is used somewhat sparingly, so that it all finally evaporates from the surface, two effects follow: first, the greater amount of water passing first downward, and then upward through the upper strata of the soil, tends to exhaust it more thoroughly of its alkali, concentrating all of it at the surface; second, by irrigation the soil is moistened to a greater depth than it was by the rainfall only, and thus a greater amount

*Alkali lands, irrigation, and drainage in their mutual relations.* By E. W. HILGARD. Sacramento, State. 8°.

of soil is exposed to this leaching action, and more alkali put in circulation, particularly if these lower strata are rich in alkali or materials yielding it.

If, on the other hand, the water is used lavishly but without proper provisions for drainage, evil effects are produced in a somewhat different way. In this case the level of the hydrostatic water of the soil (its water-table) is brought nearer the surface. The water has a less distance to rise by capillary action, hence rises more abundantly and for a longer time, and an accumulation of alkali is brought about. In one or other of these ways is brought about the phenomenon well described in local nomenclature as the 'rise of the alkali,'—a thing which is threatening most serious injury to the irrigated lands of the San Joaquin valley.

All these and other points are brought out most plainly in detail in the report before us. One interesting point deserves special mention. Analysis shows that the alkali of these soils is in many cases rich in plant-food, often containing phosphates and potash salts in practically inexhaustible quantities, and not infrequently considerable amounts of nitrates; and that, if its excessive accumulation can be prevented, the soils containing it will prove extremely fertile.

The question of remedies is fully considered. When irrigation is practised, the prime condition of success is a thorough system of drainage, combined with an occasional flooding with a large quantity of water, in order to wash out the soluble alkali into the drainage in case the rains of the rainy season do not accomplish this sufficiently. Drainage may, further, so lower the water-table as to greatly diminish the amount of water rising through the soil, while the roots of plants can readily penetrate to considerable depths for a supply of water. The author is very emphatic in his statements that irrigation without provision for drainage is suicidal.

Second in importance to drainage is thorough cultivation of the surface in order to diminish evaporation. Mulching has a similar effect. This necessitates, however, the cultivation of crops admitting of tillage. Hitherto wheat has been the staple crop of the region under discussion, regarding which Professor Hilgard remarks that "it would really seem as if, in the broadcast culture of cereals, the farmers in the alkali districts had made the worst possible selection for the permanent good of agriculture in their region." As crops suited for alkali soils, he suggests alfalfa (a deep-rooting crop, which shades the ground and thus diminishes very largely surface-evaporation) for a forage-crop, and also roots, where these can be utilized for feeding purposes. As crops for sale, he suggests, first, cotton; then the castor-bean; further, fruits, especially raisins and prunes; and possibly sugar-cane and sorghum.

As supplementary to drainage and tillage, certain chemical antidotes may be employed. Land containing carbonate of soda is greatly benefited by gypsum; a double decomposition yielding, in the presence of water, carbonate of lime and sulphate of soda, both relatively innocuous as compared with carbonate of soda. Soluble earthy and metallic sulphates and chlorides may be precipitated by lime, or sometimes by calcareous marl even.

It is evident, however, that these chemical antidotes only change the nature of the alkali, but do not remove it from the soil. Indeed, they tend rather to add to the amount of easily soluble matters in the soil, and, when the amount of alkali is at all large, are to be looked upon simply as adjuncts to the measures before mentioned.

Thus far the irrigation-water itself has been tacitly assumed to be pure. In fact, however, this is by no means the case; and a most important part of Professor Hilgard's work upon this matter has been his examinations of the water available for irrigation. The water of Tulare Lake, for example,—one of the large bodies of water that had been counted on for purposes of irrigation,—was found to contain so much alkali, especially carbonate of soda, as to render it unfit for irrigation. Kern Lake and Buena Vista Lake were found to be even more alkaline than Tulare Lake. These waters, *when concentrated in the soil by evaporation*, must rapidly increase its content of alkali, and prove fatal to all cultivated crops. Even the purer waters of the rivers were found to contain more or less alkali; and in regard to them all, the necessity of combining drainage with irrigation is to be emphasized.

A most interesting and instructive appendix to Professor Hilgard's report is constituted by the report of the '*reh* committee' for the Aligarh district, northern India, *reh* being the Hindoostanee equivalent of 'alkali.' From this it appears, that, in the irrigated districts of northern India, the same phenomena have been observed as are now developing themselves in California; and the government is now confronted with the necessity of carrying out difficult and costly remedies, or apparently of abandoning altogether or in large part its system of irrigation. In regard to the question of remedies, the Indian committee is substantially at one with Professor Hilgard, making due allowance for the fact that in India the question is one of remedying an existing evil, while in California it is as yet largely one of prevention.

SCIENCE.

FRIDAY, MARCH 25, 1887.

## COMMENT AND CRITICISM.

PROF. ALFRED MARSHALL, the university successor of Fawcett, comes forward in the current number of the *Contemporary review* to propose remedies for fluctuations of general prices. His thesis is that the greater part of the fluctuations of general prices are not of such a nature as to be capable of being diminished, as some suppose, by the adoption of two metals instead of one as the basis of currency, but that the true and only effective remedy for them lies in divorcing the currency from the standard of value, and establishing some other and authoritative standard of purchasing power independent of the currency. This is a plan by no means new in the literature of economics, but Professor Marshall urges it with particular reference to present economic conditions. His first step is to prove the evils of a fluctuating standard of value, which is a tolerably easy task. The second step will meet with more opposition; namely, that the precious metals cannot afford a good standard of value. By an ingeniously constructed diagram, the writer illustrates the fact that prices show about as much variation when estimated in terms of the two metals, gold and silver, as they do when estimated in gold alone. From this he infers that the adoption of a bimetallic standard would, in the long-run, give us prices hardly more stable than they are now. In order to the establishment of a bimetallic standard, however, negotiations with other countries would have to be entered into. Before undertaking this, Professor Marshall asks that inquiry be made as to whether the standard of value ought not to be altogether independent of the currency.

"The industrial arts generally," says the writer, "have progressed by substituting several specialized instruments for one that used to be applied for many purposes. The chisel and the plane, the hammer and the saw, are all developments of the primeval tomahawk: they do their work well, because none of them is expected to cover a wide range of work. And so, if we have one thing as a medium of exchange, and another as a standard of value, each may be able to perform its share of the work thoroughly well, because it is specially fitted for it. The currency will retain a material form, so that it may 'run' from hand to hand as a medium of exchange; while the amount of the currency which is required to discharge a contract for deferred payment will be regulated neither by weight nor measure, but by an authoritative table of figures issued from time to time by a government." This supposititious government department, then, would extend to all commodities the action now taken by the English commissioners of tithes with regard to barley, wheat, and oats. It would ascertain from time to time the prices of all important commodities, and publish at intervals the amount of money required to give the same purchasing power as one pound had at the beginning of, say, 1887. This standard unit of purchasing power Professor Marshall would call the 'unit.' In effecting a loan, it could be made in currency or in units. If made in units, the lender would know that whatever change might take place in the value of money, whether it were an appreciation or depreciation, he would receive on the repayment of his loan an amount of money that would enable him to purchase just as much and as many commodities as the amount he had loaned. Under this plan Professor Marshall believes that the heavy risks caused by a general rise and fall in prices would be avoided, and each trade would be left to contend with its own peculiar dangers only. His standard, he admits, would not be free from all imperfections, nor always easy to obtain, but it would be as serviceable for its purpose as a yard-measure, and the same sort of an advance over the use of the value of gold, or even the mean between the values of gold and silver, as a standard, as is the substitution of the yard-stick for the length of the foot of one judge or for the mean between the lengths of the feet of two.

THE RESULTS OF THE STUDY of typhoid-fever in both this country and Europe during the past decade have been of great value to sanitarians and to the public. It would seem that the facts already discovered must indicate methods by which this disease, which is well-nigh universal,

may be controlled, and perhaps ultimately exterminated. There seems to be no doubt that the bacillus which was described by Eberth in 1880 is the germ of the disease. On this point Dr. Sternberg, in a paper read at the meeting of the Association of American physicians, says that pathologists are disposed to accept this bacillus as the veritable 'germ' of typhoid-fever, notwithstanding the fact that the final proof that such is the case is still wanting. This would consist in the production in man, or in one of the lower animals, of the specific morbid phenomena which characterize the disease in question, by the introduction of pure cultures of the bacillus into the body of a healthy individual. Evidently it is impracticable to make the test upon man, and thus far we have no satisfactory evidence that any one of the lower animals is subject to the disease as it manifests itself in man. Typhoid-fever discharges have been fed to swine, apes, dogs, cats, guinea-pigs, rabbits, white mice, calves, and fowls, without any positive results. The evidence upon the etiological relation which Eberth's bacillus bears to typhoid-fever is summed up as follows: No other organism has been found, after the most careful search, in the deeper portions of the intestinal glands involved in this disease, or in the internal organs. On the other hand, this bacillus has been demonstrated to be constantly present. The various facts observed in connection with this disease indicate that it is due to a micro-organism which is capable of multiplication external to the human body in a variety of organic media, at comparatively low temperatures, and that it is widely distributed. From the endemic prevalence of the disease over vast areas of the earth's surface, we may infer that it is induced by a hardy micro-organism which forms spores. Eberth's bacillus complies with all of these conditions. The paper of Dr. Sternberg is an admirable *résumé* of all that is best in modern experimentation and research in connection with this bacillus, and may be found in the Transactions of the association of American physicians.

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AS SPRING APPROACHES, the interest in cholera begins to revive. It will be remembered that last year a cholera commission was despatched from England to Spain to study the epidemic in that country. The members of the commission were Drs. Ray, Graham Brown, and Sherrington, and represented the Royal society, the University of Cambridge, and the Association for the promotion of scientific research. In a preliminary report recently made by them, some of the results of their investigation are given. They failed to find Koch's bacillus in all the cases, and they do not look upon it as being the cause of the disease. They claim to have discovered a new fungus, which has been pronounced to belong to the Chytridiaceae. It consists of granular masses and a delicate mycelium. The commission evidently do not feel thoroughly convinced that they have discovered the veritable germ of cholera, as they recognize that further investigation is necessary before its etiological relation to cholera is firmly established. For our part, we prefer to accept the views of Koch, whose experience gives him opportunities for investigation possessed by few.

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FOR SEVERAL YEARS PAST, a suspicion has been current among students of glaciology in this country that the European studies of the drift were not advanced quite as far as similar studies with us. It is not only that our terminal moraines have been traced and mapped with unexpected detail, but they have given great additions to the evidence for land ice as against floating ice action, and they have vastly increased our knowledge of the style of motion characteristic of a continental ice-sheet. Similar revelations have been expected concerning the extinct ice-fields of Europe, as soon as their marginal deposits should receive proper correlation, and the expectation seems well justified by the work of Mr. Carvill Lewis of Philadelphia, who during a two-years' trip abroad has attempted the investigation of the English and Irish drift-margins after what may be called the American method His studies were presented at last summer's meeting of the British association, and are now published in the *American naturalist* and in the *American journal of science.* They give account of curvature and irregularity in the drift-front, of interlobate moraines with kettle-hole topography, like the classic example is Wisconsin, — for in this matter we have our classics at home, — and of the critical differences between the working of floating bergs and creeping sheets. This must excite interested comment from those who have not yet made such interpretation of glacial deposits, and awaken agreeable anticipation of the greater discoveries yet to be made on continental Europe.

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Another interesting effect of American geological work in Europe appears in a small way in

the annual of the French Alpine club for 1884. Mr. de Margerie, whose studies of our recent geological literature have done much to make it known in France, a few years ago prepared reviews of Captain Dutton's monograph of the Colorado Cañon, and published them in the bulletin of the French geological society as well as in the annual of the Alpine club, inciting thereby the preparation of an admirable view of a great 'cirque' in the Pyrenees by Mr. Schrader, a fellow club-member. "Shall it be," says Schrader, "that the cañon of the Colorado, so far away, becomes better known in France than the Cotuatero, on the very frontier of the country?" Doubtless the dimensions of the American plateau and cañon are greater than those of the massive Cotuatero and cirque in the Pyrenees, but the latter have the advantage in rising from a forest-clad base to a snow-crowned summit. The colored plate illustrating the Cotuatero is a thoroughly artistic and appreciative work, and it is grateful to find that the illustrations in our survey reports have been instrumental in securing its publication, and in bringing it before an interested circle of the French public.

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These European Alpine clubs are producing a valuable literature of their own. They have, to be sure, the advantage of high snow-mountains that tempt travel and climbing; their membership is large, with many sectional meetings and excursions; and their treasuries are correspondingly well supplied, enabling them to publish selected material in well-illustrated annual volumes. The English Alpine club is more conservative than most of the others in these respects, as its matter is largely composed of narratives such as its adventurous members can well contribute, not only from the Alps, but from the Caucasus, the Himalaya, New Zealand, and the Andes, where they now seek new fields, taking trained Swiss guides with them. The Swiss club holds closely to its own country, but gives a good share of attention to scientific matters in its line, as well as to narratives and descriptions. Forel reports, for example, on the oscillations of glaciers; and our summer travellers will be glad to see from his diagram that the recession of the ice, that lately threatened seriously to diminish one of the main attractions of the Alps, reached its maximum about 1876, and is now followed by a well-marked advance. Long panoramic views from mountain-summits make a characteristic feature of these volumes, an annual bibliography of Alpine literature adds much to their value, and an index lately prepared for the first twenty volumes greatly increases their utility. The first volume is unfortunately extremely rare, as is the case in several other clubs; and a republication of the early numbers, such as has been lately done by our active Appalachian mountain club, would give general satisfaction.

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The German-Austrian club is a union of two originally independent societies, and has a very large membership. Under its auspices an excellent 'Guide to scientific observation on Alpine journeys' was published a few years ago, and is by far the best book of its kind. The annual of the French club is naturally more vivacious than any of these others. Its articles are attractively written, and many of the woodcuts are extremely good. Scientific papers have a good showing, though lacking the systematic sequence of those in the Swiss 'Jahrbuch.' Some of the narratives have so little to do with Alpine matters that the annual might almost be called a geographic journal. Deep-sea exploration is introduced under the title of 'Les montagnes de le mer,' and Janssen describes his astronomical voyage in the Pacific to the Caroline Islands, any thing but a mountainous isle, for the solar eclipse of 1883. But to make up for this, one member climbs and photographs Popocatapetl, and another visits the volcanoes of Java, bringing home a well-illustrated account of his travels. The Alps naturally have most attention, but the Pyrenees come in for a good share, and much information of this comparatively little-known range is to be found in these attractive volumes. It is indeed regrettable that our White Mountains have not the few thousand additional feet of elevation that would cover their summits with snow and fill their valleys with glaciers, to the admiration of all.

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A RECENT BULLETIN of the U. S. fish commission states that the total distribution of shad fry for the season of 1886 amounted to 90,000,000. As the entire number of shad taken for the market is less than 6,000,000, it will be seen, that, for every shad taken from the waters this season, there have been artificially hatched and returned to the waters fifteen young shad. Assuming that the entire cost of production and distribution has been $20,000, the young fish have been produced and distributed over the entire United States at a

rate of about $215 a million, or about 46 fry for one cent. Another interesting fact to note is, that, for the entire time up to and including 1882, there were produced 200,000,000 young shad; while, for 1883 alone, the total was over 90,000,000. This indicates that we are certainly approaching a position where the work may be regarded as profitable from a commercial stand-point.

## *THE COAST TRIBES OF BRITISH COLUMBIA.*

Dr. Franz Boas, who visited the tribes of British Columbia in the fall of 1886, gives the following preliminary report (with map) on some results of his journey: —

Vancouver Island and the mainland opposite are inhabited by numerous tribes, which belong to three linguistic stocks, — the West Vancouver tribes, of the outside coast of Vancouver Island; the Selish tribes, which occupy the south-east part of the island as far as the narrows separating it from the mainland, and inhabit the banks of the lower part of Fraser River and the neighboring fiords; and the Kwakiutl tribes, which occupy the northern part of the island, and the mainland as far north as Gardner Channel. The latter tribes surround the territory of the Bilhula of Bentinck Arm and Dean Inlet, a tribe belonging to the Selish stock. Farther north we find the Tsimpshian and Tlingit on the mainland, and the Haida on Queen Charlotte Islands.

The Selish language is divided into a great number of dialects, differing widely from one another. Under the name 'Coast Selish' we include the dialects of Puget Sound and of the Gulf of Georgia, as those dialects are more closely connected with one another than with the Selish dialects of the interior.

Through the descriptions of Swan, Sproat, Krause, and others, the mode of life of these tribes is tolerably well known. Their large wooden houses, their canoes, their fishing-gear and hunting-methods, have been frequently described; but their traditions, religious ideas, and social organization are not known equally well. According to all observers, the principal figure in the mythology of the Tlingit is the raven Yetl, who created the sun, moon, and stars, who gave man the fresh water and the fish, and whose exploits are said to be so numerous that a lifetime is not sufficient to relate them all. Dawson found the same traditions among the Haida; and, according to the Rev. Mr. Duncan, the Tsimpshian tell the same stories of Tghemshen, the man who was able to transform himself into a raven. It is a characteristic feature of the 'raven' legend that the bird did not create all things for the benefit of mankind, but in order to revenge himself. While studying the tribes of Vancouver Island, numerous traces of this legend were found, though only very fragmentary and disconnected. Among these people the raven is not considered the creator of the sun, the water, the trees, etc.; but his adventures, which generally refer to his voracious appetite, and his cheating people and animals in order to satisfy it, are frequently related by the natives.

The most important legends of the Kwakiutl are those referring to Kanikilak. They believe in a supreme being living in heaven, whom they call Kantsoump ('our father,' or, in some instances, 'our elder brother'). He sent down to the earth his two sons Kanikilak and Nomokois, who were born there again of a woman, the wife of the woodpecker. Their mother's blanket contained the salmon, which they liberated by dipping the corner of the blanket into the water. Then Kanikilak travelled over all the world, becoming the friend of all the mighty chiefs whom he met on his way, and transforming all the malignant men into animals. The name, in the Kwakiutl language, of those ancient beings who were neither men nor animals, is Nughnemis. We find the same or a similar tradition belonging to all the tribes from Puget Sound to the district of the Tsimpshian. Among the Selish tribes the name of the son of God is Häls; among those of the west coast the name is Alis. The northern tribes — the Tsimpshian, Haida, and Tlingit — tell of those human-like beings which were transformed into animals during a great flood.

The supreme being spoken of above seems to have originally been the sun, though the identity of both does not appear very distinctly in the traditions of the natives. However, their ancient identity may have been lost in course of time, as among all the tribes legends of different origins are evidently intermixed. In the same way as the raven story has spread south, losing on the way its important place in the mythology of the tribes, the Kanikilak story seems to have spread north; and the traditions, in their present state, seem to consist of elements of at least two different origins. The Skoamish call the sun 'the great wandering chief.' The Nanaimo (Snanaimugh), in speaking of the sun as the supreme being, call it Shimthayith. The Bilhula call their supreme being, besides Taata ('our father'), by the name Sngh, which is evidently connected with *sŏngh* ('sun'). In the Kwakiutl legends the sun is the father of the mink, and this tradition is so closely connected with others relating to the


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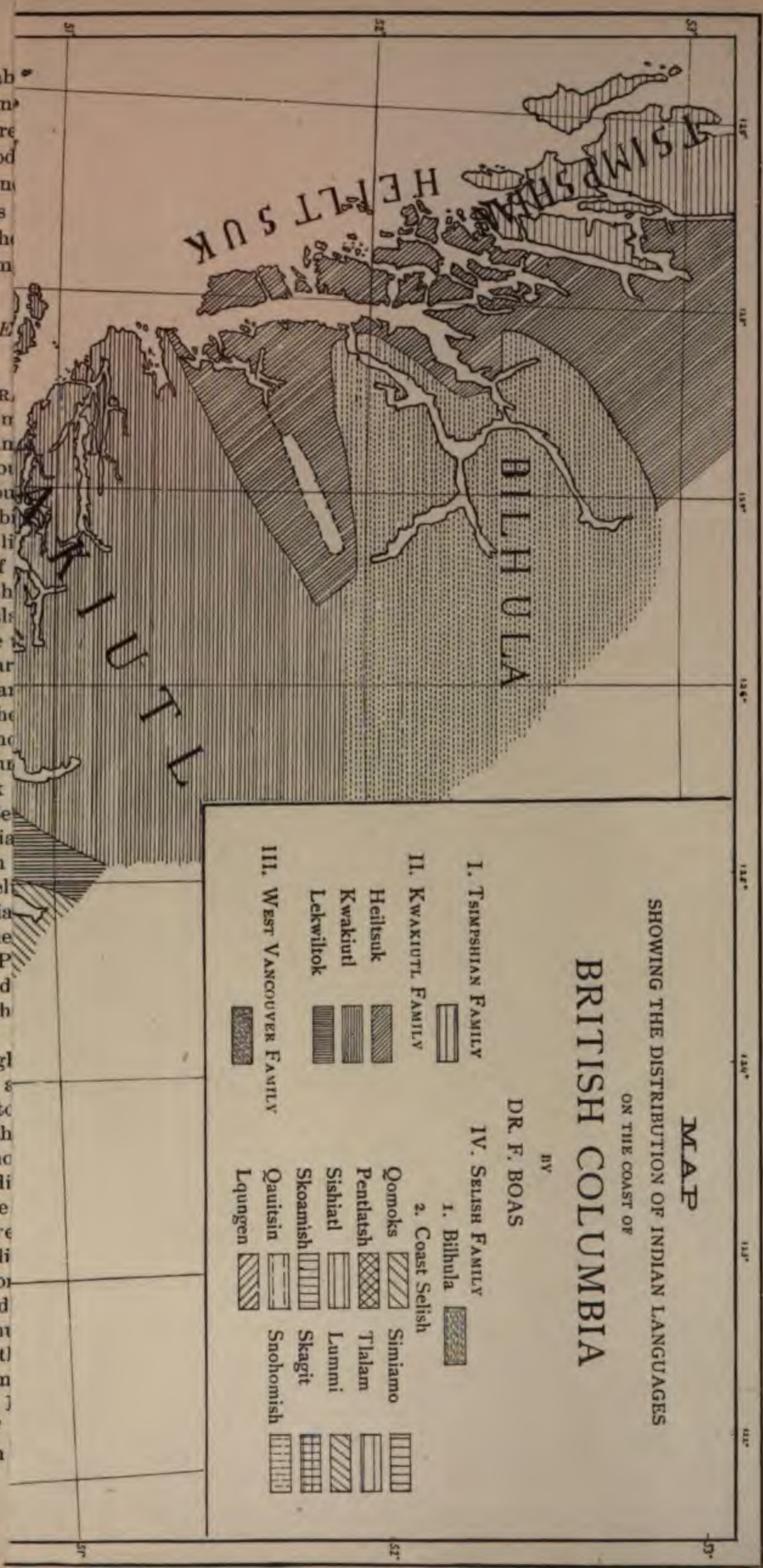

supreme being, that the identity of both becomes highly probable. The tribes of the southern part of Vancouver Island ascribe to the mink all the exploits that are told farther north as having been accomplished by the raven, and add a great number of others which belong to the mink alone. The Qomoks of the central part of Vancouver Island relate both traditions separately. Those of the raven refer to its voracious appetite, while those of the mink have a highly erotic character.

The Qomoks, Heiltsuk, and the Bilhula of Bentinck Arm are particularly interesting, as we may observe with them the transferrence of legends from one tribe to another. The Bilhula have a tradition of their own describing the origin of mountains, woods, and animals, which, though influenced by the legends of the Tlingit and Tsimpshian, has a peculiar character. They say that after the raven had created the sun, four men — Masmasalanigh, Yulatimot, Matlapalitsek, and Matlipekoagh — descended from heaven and created every thing, after which they returned. Masmasalanigh and the raven are said to be identical, and all his works originated in Yulatimot's mind. The same tradition is found among the Heiltsuk. Though they speak a dialect of the Kwakiutl, their customs and their belief are closely allied to those of the Bilhula. They say that two men, Masmasalanigh and Noakaua, descended from heaven and created every thing. Similarly the Qomoks, who belong to the Selish family, have adopted a great number of traditions and customs of the Kwakiutl.

The most important of these is the cannibalism connected with the winter dances. The custom prevails among the Kwakiutl, Tsimpshian, Bilhula, and Qomoks, and is said by some natives to be practised by the Tlingit. According to the Kwakiutl tradition, one of their ancestors descended from heaven, wearing a ring of red-cedar bark, and taught people the cannibal ceremonies. The Tsimpshian tell of a man who, in pursuit of a bear, came to a mountain that closed upon him. In the interior he learned the dances connected with the cannibal ceremonies, and taught them to his tribe after his return. This custom has evidently been adopted only by the Bilhula, as none of the Selish tribes except the Qomoks practise it. The latter have adopted only part of the ceremonies, and replace the terrible practice of devouring corpses by eating artificial ones, that are made by sewing dried halibut to a human skeleton.

Among the northern tribes originated the use of the well-known copper plates, which are highly prized, and which increase in value the more frequently they change their proprietor, and the longer their history is. They became known to the Bilhula quite recently, and I am told by old natives that they have never been in use among the Indians at the mouth of Fraser River.

There is a remarkable difference between the social institutions of the Tsimpshian, Tlingit, and Haida, and those of the rest of the tribes. Among the former the children belong to the gens to which the mother belongs: among the latter they follow the father's gens. This fact indicates a close connection between the Kwakiutl and Selish tribes; and, as a consideration of the languages shows some affinity of the two peoples, it is possible that the Kwakiutl are a remote branch of the Selish stock. The animal crest which prevails in the north is not found among the southern tribes. Their gentes derive their origin from a fabulous being which descended from heaven dressed in a bird's skin or in the shape of a man. Members of one gens are not allowed to intermarry, but have to take their wife or husband from another gens. In some of the tribes there are as many as from fifteen to twenty gentes.

Every tribe owns its district for fishing and hunting purposes and for gathering berries. Inside the boundaries of the tribe, each family has its own claim to certain rivers and parts of the coast, which they derive from their ancestor; but we are far from knowing the actual distribution of tribes and gentes. Even their number and names are still doubtful in many of the districts.

The common culture which extends over tribes of a great number of linguistic stocks of the north-west coast is one of the most attractive problems of American ethnology, and one deserving a thorough study. However, the ethnological character of these Indians is disappearing rapidly through their permanent contact with the whites; and within a few years it will be too late to collect the vast material that may readily be gathered at the present time. Puget Sound, the Selish of the interior, the Tsimpshian, are actually unknown, and an explorer may glean ample results by visiting some of these tribes, and contribute new and valuable material to American ethnology.

## *LONDON LETTER.*

THE theory of Prof. G. H. Darwin, enunciated in a recent number of the *Fortnightly review*, that the actual origin of earthquake-shocks is usually to be traced below the bed of the sea not far from the coast, will probably receive a certain amount of confirmation when all the observations on the recent earthquake in the Riviera are collated and discussed. The steamship Carina, of Cardiff, off Savona, on the morning of the fatal Wednesday,

experienced a terrible motion for three or four minutes, as though the propellor had dropped off and the engines were racing terribly. Several fishermen, having noticed on the previous night unusual movements of the water on the shore-line, were afraid to go on shore to sleep.

The Lords' committee of council on education have just taken a new departure in the use of the South Kensington museum, library, and schools. Arrangements have been made for the study there, without any fees, for periods of from two to nine months, of persons engaged in those industries in which art is more or less concerned, the sole condition being that the proprietors of works in whose employ such students are, shall undertake to maintain them while they are thus engaged in studying. We trust that this is only a prelude to the employment of the science schools of the department in a similar way.

An active discussion is going on in the University of Cambridge as to the arrangement of specimens to be adopted in the new geological museum, which has yet to be built, and the site of which is still undecided. Professor Hughes heads the party which desires the stratigraphical arrangement, so as to present the earth's development at different epochs. The other party, led by Professor Newton, advocates the zoölogical arrangement, so as to display the development of particular orders of plants and animals ; and, with this view, it desires that the new museum should be placed as close as possible to the Museum of comparative anatomy, so as to facilitate a comparison of existing types.

A year ago, Professor Langley, the distinguished American astronomer, performed an experiment in the theatre of the Royal institution to explain his theory that the true color of the sun was blue. A few nights ago, in a lecture upon 'Sunlight colors,' Captain Abney repeated this experiment, adopting Professor Langley's figures, but dispensing with his paper disks, which, he held, vitiated the result. As the result of this, he maintained that the color of the sun was very nearly that of white light seen at high elevations in a clear, dust-free atmosphere. When the spectra of sunlight on the Alps and the spectra as imagined by Professor Langley were compared, they were almost identical. In support of some of his views, Captain Abney showed a novel and beautiful experiment, called an 'artificial sunset.' Through a solution of sodium hyposulphite, a clear circle of electric light was thrown on a screen : a few drops of hydrochloric acid added to the solution precipitated the sulphur in fine particles, and first the violet, and then the blue, green, and yellow rays were successively cut off, until finally there was the dull red of the sun setting in a wintry or a smoky sky. The effects of clearness of atmosphere on photographs were strikingly shown in Alpine and Egyptian pictures.

A serious outbreak of anthrax, or splenic-fever, recently occurred near Chelmsford, Essex, and it has communicated itself to several human subjects. Anthrax has long been known to be synonymous with that fatal human ailment 'woolsorters' disease.' In one of the present cases a veterinary surgeon bled one of the animals, and some of the blood fell upon his shirt-sleeve. A pimple upon his arm was rubbed or scratched, and, the tiny raw spot touching the blood-stained sleeve, an unhappily successful inoculation was effected. Various possible causes of the outbreak are speculatively assigned, one being the feeding with pollard made from foreign corn.

The board of trade have appointed a committee to inquire into and report upon the desirability of electrical communication between lightships and the shore, with the special object of facilitating the saving of life at sea.

Sir Fred. Abel, the organizing secretary to the 'imperial institute,' designed to commemorate the jubilee of the reign of Queen Victoria, has addressed letters to the presidents and councils of several of the scientific societies, with a view of obtaining subscriptions to the scheme through those channels. Invitations to members to subscribe thereto have accordingly been issued by most of these bodies. Besides the institute fund, the Society of telegraph engineers appeals for separate subscriptions towards a telegraph jubilee fund, to be devoted to an entirely distinct purpose.

It is stated on excellent authority that a new and cheap insulating material and system of laying underground telegraph-wires has just been devised by Messrs. Callender & Co. of London and New York, by which a hitherto unapproachable speed of signalling can be obtained on underground lines. If what is stated be correct (and there seems no reason to doubt it), the problem which has occupied some of our best electricians for some years has been successfully solved.

A movement is on foot to obtain government aid for the various 'university colleges' in the larger English towns. Similar colleges in Ireland and Scotland have long received such aid, and very recently three Welsh colleges have obtained grants of twenty thousand dollars per year each. The English colleges (in Manchester, Newcastle, Bristol, Birmingham, Liverpool, Leeds, etc.) are entirely without such help, and in some cases, notably in Bristol, they are in serious pecuniary

embarrassment. The excellent character of the scientific work done in many of them is justly adduced as a reason for the request.

Prof. A. W. Williamson, F.R.S., has just resigned the chair of chemistry at University college, London. W.

London, March 7.

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## GEOGRAPHICAL NOTES.

### *Africa.*

J. T. Last, commander of the London geographical society expedition to the Namuli Hills in East Africa, has sent a report of his trip to the south end of Lake Nyassa. Some of his remarks are of general interest. Starting from the mission station at Blantyre, he passed by Lake Shirwa, ascended Mount Zomba, which he found to be five thousand feet high, and visited the country of the Angoni, south-west of Lake Nyassa. He states that the district around Zomba proves to be very fertile. The English plantations in that district have fine crops of coffee. The culture of tea, cocoa, and arrowroot is being tried, and they promise to do well. On his way north he crossed the Shire, the eastern bank of which is quite uninhabited, while the western one is well-peopled and very fertile. As the kings of the Angoni and Yao — which latter live on the Shire — have made some terms of friendship, the petty wars between the tribes have ceased, and Last travelled without any trouble arising from this source. At the outlet of the Nyassa he encountered a low and sandy country with numerous patches that are covered with water during the wet season, salt being deposited when the water evaporates. The Angoni district, south-west of the Nyassa, forms a large plateau about five thousand feet high, which extends far west. In all this district there is scarcely a tree to be seen, and the fuel commonly used by the people is cornstalks and ox-dung. The land near the east is very poor, but as one proceeds towards the west it greatly improves in appearance, and in its western portions it is extensively cultivated. The expedition returned to Blantyre on the 1st of July. On the 12th they left again, and arrived at the Namuli Hills in August.

The Spanish traveller Sorela Fajardo arrived on the Senegal on Feb. 27. He proposes to cross the continent from west to east, starting from St. Louis in Senegambia.

### *America.*

N. S. Shaler discusses in his paper on 'Fluviatile swamps of New England' (*Amer. journ. sc.*, March, 1887) the formation of river-valleys in New England, more particularly in eastern Massachusetts. A comparison between the rivers flowing north and those running south shows a great difference in the character of their valleys. The former have excavated the glacial deposits which filled their valleys, and deposited alluvial plains that have distinct terraces. The erosion of the old deposits is still continuing. The rivers running south have excavated part of their glacial deposits, but the process ceased a long time since. None of them have sufficiently strong current to clear their beds from the detritus carried into them by floods from their tributaries, and coarse sediments are continually being deposited in their valleys. Shaler supposes that these plains were formed while the river was at a lower level than it is at present, and became swampy by the same changes on the drainage conditions which have so obstructed the flow of the stream. These facts tend to show that the northern slope of the valleys has been diminished. Thus the eroding force of the rivers which run south has increased, while that of those running north has so much decreased as to stop their eroding action. Shaler estimates the tilting of the land necessary to have this effect to be two feet to the mile, and concludes, from the well-known observations on submerged forests on the New England coast, that it consisted in a lowering of the southern part. The result of his researches as to the recent geological history of this district are that the uneven glacial banks were deposited while the land was submerged. When the ice retreated, a re-elevation took place, after which the glacial deposits were rapidly excavated. With the disappearance of the ice from the continent, the southern portion became lower again, and the latter movement produced the swampy character of the valleys of rivers running north by putting an end to the eroding action of their waters.

The Mississippi River commission has just issued a map of the alluvial valley of the Mississippi River from the head of St. Francis Basin (latitude 37° 20′ north) to the Gulf of Mexico, showing lands subject to overflow, the location of levees, and trans-alluvial profiles, on a scale of five miles to an inch (1:316,800). The topography is reduced from detail maps and surveys made by the various government offices and railroads. The object of the map being to illustrate the floods of the Mississippi, the district which is subject to overflow is marked by brown hachure lines, the hydrography and lettering being printed in black. A great number of section-lines and the profiles belonging to them are embodied in the map. The profiles show the high-water line of 1882. Though these profiles are of a darker brown than that of the district subject to inundation, they somewhat dis-

tract the attention from the outlines of those districts. However, the additional information contained in the profiles fully makes up for this disadvantage, particularly as the map is on a large scale, and intended for a special study of the hydrography of the Mississippi.

An advance copy of a geological map of the northern part of the Dominion of Canada, by George M. Dawson, has been received. It embraces arctic America from latitude 60° north, and the adjoining parts of British Columbia and Labrador. The geological coloring is based on the explorations of the geological survey of Canada and on other authorities. The geological structure of the district west of the Mackenzie is still unknown. The most interesting parts of the map are the carboniferous area of the Parry Archipelago, which stretches from the outlet of Robeson Channel into the Arctic Ocean to Banks Land; and the adjoining Devonian and Silurian belt, which stretches in a continuous line from the east coast of Kane Basin to Hayes Sound, North Devon, and the Mackenzie River. The close connection between the geological structure of Grinnell Land and Parry Archipelago is very interesting. Its existence makes the exploration of the unknown area between those islands very desirable. Every thing tends to show that it is probably occupied by a group of islands, and therefore it is probable that an exploration might be accomplished without great difficulty or danger. The field for arctic explorers is not to be looked for only in the extreme north: the unknown districts which are comparatively easily reached deserve as much attention. Another interesting point of the map is the Devonian or Silurian basin of Fox Channel and Baffin Land, and that of Hudson Bay. It would have been desirable to have what little there is known of the orography of arctic America in this map, as it would help to give a clearer idea of the geological character of those districts.

The boundary between Venezuela and Brazil was surveyed in the years 1880 to 1883. The report of the work of the joint commissions has been prepared by the chief of the Brazilian commission, Lieut.-Col. Francisco Xavier Lopez de Araujo, and is printed in the Brazilian parliamentary papers (Rio de Janeiro, 1884). The map which accompanies this report contains much new information. The exploration of the Maturaca revealed the fact that the Orinoco and Rio Negro are not connected by the Cassiquiare alone, but that a great number of bifurcations exist which form a large island that has been named 'Ilha Pedro II.' On the subsequent journeys the river Padauiry and the Serra Curupica were explored. The expedition did not visit the district inhabited by the Maracañas and Kirishanas, who do not allow the whites to enter their territory.

## NOTES AND NEWS.

WE learn from *Modern language notes* that the English folk-lore society has invited Prof. T. F. Crane of Cornell university to edit for the society the *exempla*, or illustrative stories of Jacques de Vitry, bishop of Acre, and historian of the Crusades. This compliment to American scholarship is specially marked, because Professor Crane was intrusted with the work with no limitations whatsoever. The *Athenaeum* adds, that these stories are about three hundred in number, and are contained in the hitherto inedited manuscripts No. 17509, Bibliothéque nationale, Paris. They are of great value for the question as to the diffusion of popular tales. They contain every variety of story, from the jest to the *conte dévot*, and are especially rich in fables, among them the oldest European version of 'The milkmaid and the pot of milk.' Professor Crane's edition will consist of an introduction on the life of Jacques de Vitry and the use of *exempla* in mediaeval sermons, the Latin text, and a brief translation or analysis in English, with comparative notes. It will probably be ready by the end of the year.

—The dome for the Lick observatory is well under way at the Union iron-works in San Francisco. It is 70 feet in diameter, will weigh 90 tons, and is to be revolved with a pressure of 135 pounds. The cost of the dome is $56,800.

—The daily papers recently announced the startling discovery that the earth had been retarded in its daily revolution ten minutes and eleven seconds between Feb. 25 and March 3, 1886, and anxious inquiries were made as to the causes and effects of this slowing-down. We are a little surprised that this absurd story comes, not from a wild theorist with unbounded faith in the maxim that figures will not lie, but from a practical man, "taking observations of the sun in his business of regulating and adjusting chronometers for masters of vessels arriving at Wilmington"!

—Dr. Peters of the Hamilton college observatory has given the small planet, No. 264, which he discovered on the 17th of December, the name Libussa. No. 256, discovered by Dr. Palisa, has been named Walpurga. A new asteroid, 265, was discovered by Palisa at Vienna on Feb. 27.

—The lectures under the auspices of the philosophical, anthropological, and biological societies of Washington are announced as follows: March 12, Gen. A. W. Greely, U.S.A., Animals of the

arctic regions; March 19, Capt. C. E. Dutton, U.S.A., Earthquakes; March 23, W. J. McGee, The Charleston earthquake; March 26, Prof. Otis T. Mason, The natural history of human arts; April 2, Dr. B. E. Fernow, Our forestry problem; April 6, Thomas Wilson, Prehistoric man in western Europe.

— Prof. J. R. Dodge, statistician of the agricultural department, has been appointed an official delegate to the international statistical institute which is to meet in Rome, April 11.

— An account of the foundation and work of the Blue Hill meteorological observatory, near Boston, has lately been prepared by its proprietor, Mr. A. Lawrence Rotch. Its records were begun the last of January, 1885; and especially in the second year of their sequence, when the difficulties and interruptions characteristic of their beginning had decreased, they are remarkably elaborate and complete. Very few stations in the country possess so extensive a set of self-recording apparatus. Local weather-prediction has been successfully attempted, the data being in part local observation, in part general observations of the signal service. For the past month or two, the predictions issued from the Hill have been regularly published in some of the Boston papers. Such an experiment, giving opportunity of comparing predictions made at a local and at a central (Washington) office, are of value, and should be undertaken and published by observant meteorologists in other parts of the country. The observers at Blue Hill — Mr. W. P. Gerrish for the first year, and Mr. H. H. Clayton for the second — have had some rather severe experience. Perhaps the most severe spell of weather was in the latter days of February, 1886, during a persistent north-west gale. The wind maintained a velocity of seventy-three miles for an hour on the 28th; the pressure recorded during short gusts of wind indicated a temporary velocity at the rate of ninety-three miles an hour. The total wind-movement on the 28th was 1,467 miles; for the last three days of February it was 3,735 miles. The ice-storm of the end of January, 1886, incased the hill, trees, building, and external instruments in a heavy sheathing of ice: the telephone-wire had a girth of eight inches. At this time, frost-work, such as characterizes Mount Washington and the Brocken, attained a length of one or two inches.

— Prof. Ernst Haeckel of Jena has been studying the lower forms of aninal life in the Levant this winter.

— Prof. Alexander Agassiz, director of the museum of zoölogy at Harvard, has been made a D.Sc. by the University of Cambridge. In introducing him, the public orator referred to him as one of whose work it might be said, '*Merses profundo, pulchrior evenit.*' The allusion was to Professor Agassiz' investigations of the mysteries of the ocean.

— The first comptroller of the treasury has decided that the act establishing agricultural experiment-stations in connection with the agricultural colleges of the several states and territories makes no appropriation for the purpose of the act, but that such appropriation, according to the terms of the act, must be "specially provided for by congress in the appropriations from year to year." The operation of the act is therefore practically suspended until congress takes some further action.

— On Feb. 22, 1888, the birthday of Arthur Schopenhauer will be celebrated in Germany with much ceremony by the followers of the pessimistic philosophy.

— The *Athenaeum* reports that Professer Du-Bois-Reymond will celebrate this year the twentieth anniversary of his appointment as secretary of the Academy of sciences of Berlin. He has held the post since 1867, and it has fallen to his lot to introduce into the academy a succession of the famous representatives of the modern sciences; among others, Helmholtz, Virchow, and Siemens. On such occasions he has given proof of his great talent as an orator, and Du Bois-Reymond's 'Begrüssungsrede' has become the feature of the introductions. He is the oldest member of the physico-mathematical class of the academy. His patent is dated March 5, 1851. The venerable French chemist, Chevreul, is the only member of older standing. Chevreul was enrolled in 1834.

— Mr. Lancaster, meteorological inspector at the Royal observatory at Brussels, has prepared a well-planned and compact summary of the climate of Belgium in 1886, including annual and monthly tables, barometric and thermometric curves, and a somewhat detailed account of the months separately. The winter beginning in December, 1885, is shown to have been persistently cold, although without extremely low temperatures. February, 1886, was very dry, and, as Lancaster has found usual in such cases, was followed by a drought of several months. He quotes seven examples since 1833, in which the precipitation for February was less than half the normal mean, all of which were succeeded by dry periods of from two to six months' duration.

— A curious example of minute observation, carefully carried out, appears in a note in *Ciel et*

*terre* for Jan. 1. It is on the relation of the state of the weather to the distance at which church-bells may be heard, by P. J. DeRidder of Lebbeke in Belgium, who kept a record of the church-bells and the weather from 1870 to 1882. He finds that the sounds are heard farthest when the movement of the air is cyclonic, or, if calm, when the air is very moist: sometimes contrary winds make no obstacle to sound-transmission. Sounds are heard at the greatest distance between one and two o'clock in the morning. Certain clocks, situated six and eight kilometres south-west of Lebbeke, are called *waterklokken* by the country-folk, because a rainy period always sets in soon after they are heard.

— Dr. Bowditch reports a case of lead-poisoning in which the only discoverable source of the lead was the solder used in the kettle in which water was boiled.

— Messrs. Nicholls and Bailey recently contributed to *Nature* the results of a series of observations made by them to test the acuteness of smell in the different sexes and in different individuals. The sense of smell in the male was found to be more acute, on the average, than in the female sex. In some individuals it was so keen as to detect one part of prussic acid in two million parts of water. Several substances were experimented with, and the following is a summary of the results, the figures indicating the average limit of delicacy of perception:— Cloves: males, 1 in 88,128; females, 1 in 50,667. Nitrite of amyl: males, 1 in 783,370; females, 1 in 311,330. Extract of garlic: males, 1 in 57,927; females, 1 in 43,900. Bromine: males, 1 in 49,254; females, 1 in 16,244. Prussic acid: males, 1 in 112,000; females, 1 in 18,000.

— At a recent meeting of the Paris biological society, M. Gréhaut read a paper on 'The prevention of accidents from suffocation while descending into wells.' After referring to the cause of the suffocation, namely, carbonic-acid gas, and the well-known expedient of first lowering an animal into the well, he gives the following directions for ventilation: a stove-pipe ten or twelve feet longer than the well is deep is to be secured by wires in the axis of the well; a grate on which a fire can be built is then to be placed around this pipe at the level of the ground; and a second pipe, larger than the first, is then to be placed upon the grate, with the first pipe inside; and on the grate, and between the two pipes, a fire is to be built. The inner pipe being heated, a current is created, resulting in the ascent of the impure air of the well, and its replacement by fresh air from without.

— The following course of lectures is now in progress at De Pauw university: March 8, 'The earth,' Pres. T. C. Mendenhall, Rose polytechnic institute; March 14, 'The germ-theory of disease,' Prof. J. M. Coulter, Wabash college; April 4, 'Glaciers, past and present,' Prof. O. P. Jenkins, DePauw university; April 11, 'Charles Darwin,' Pres. D. S. Jordan, Indiana university; April 18, 'A beam of light,' Prof. J. B. DeMotte, DePauw university; April 25, 'Spectrum analysis,' Prof. P. S. Baker, DePauw university; May 2, 'The sun,' Prof. J. P. D. John, DePauw university.

— Summer courses are offered by Harvard college in chemistry, physics, botany, and geology.

— A very interesting philosophical work, by Prof. George T. Ladd of Yale, will shortly be published. It is entitled 'Physiological psychology,' and will be especially important just at this time, because, if our understanding of its scope and method is correct, it will maintain a philosophical and psychological stand-point, while admitting to their proper place the conclusions reached by physiology respecting the nature and functions of the nervous system. President McCosh's book on the 'Motive powers' is also nearly ready.

— The Turkish government has under public examination and supervision a large school for living languages. The British government is considering the expediency of imitating the example of the Turk, and a plan for the establishment of such an institution is shortly to be brought before parliament.

— The council of the Geological society awarded the medals at the anniversary meeting of the society on the 18th of February as follows: the Wollaston gold medal to Mr. J. W. Hulke, F.R.S.; the Murchison medal to the Rev. P. B. Brodie; the Lyell medal to Mr. S. Allport; and the Bigsby gold medal to Prof. C. Lapworth. The balances of the funds at the disposal of the society are awarded as follows: the Wollaston fund to Mr. B. N. Peach; the Murchison fund to Mr. R. Kidston; and the Lyell fund to the Rev. Osmond Fisher.

— In noticing the tenth report of the Historical manuscripts commission, the *Athenaeum* reviewer says, "The latest publication of the manuscripts commission is an excellent example of the method of modern historical research. The national school of history which flourishes under the direction of the master of the rolls is notoriously engaged in the collection of every well-authenticated scrap of manuscript material that is capable of illustrating some epoch or incident of English history. In this respect it has, perhaps,

set an example which is being eagerly followed by the historical bodies of most European countries. Germany, indeed, is, as well as America, already ahead of us in scientific methods of collecting and editing the more modern and political materials which may be gleaned from the archives of every state-paper office in Europe: while France, Austria, Belgium, and Sweden tread closely on our heels. The objects of modern history, therefore, though professedly national, are in fact cosmopolitan, each country opening up at times unexpected manuscript treasures for the more particular advantage of the other. Hitherto we have been content to rely chiefly upon the resources of our unrivalled national records; but every year affords fresh evidence of the extent and value of the outlying manuscript material which it is the special mission of the Historical manuscripts commission to incorporate with the main stock."

—Our retinal insensibility to the ultra-violet and infra-red rays has been recently discussed by Drs. Fox and Gould in the *American journal of ophthalmology*. The sufficient reason for the perception of the so-called 'light' rays is because the eye has learned to react to the strongest and most constant stimulus, and to extinguish or exclude those vibrations that would only confuse by their weakness or inconstancy, or that would with difficulty be focused with the rest. As to the range of vision along the spectrum, the remarkable fact is, not its narrow limits, but its extension. The marvel is that we have learned to see the violet rays at all, when they are so weak. The limit at the red end of the series is thought to be determined by the great absorption gap in the spectrum that separates the visible from the infra-red rays. It is then asked, how are the invisible rays excluded from stimulating the nerves? and although no satisfactory or final answer can be given, based on experiment, it is made at least probable that they are absorbed by the media of the eye before they reach the retina.

## LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### A sensitive wind-vane.

AN interesting discussion of this question has recently been initiated, and it may be well to give a portion of this and a few considerations bearing on the problem. I have seen it stated that a flat vane is always in a neutral line, and a sensitive one is made by fastening two plates together at an angle of about ten degrees. This statement has always appeared chimerical to me, for the reason that such a vane as described would have twice the weight and friction of a flat vane, and hence could not be as sensitive as the latter. We should gain, at the outset, a clear definition of what is meant by a sensitive vane. A very light structure, like a feather attached to a cord or balanced near one end, while tossed hither and yon by every breath, and exceedingly sensitive, could hardly be what is meant. I would say, as a first idea, that a sensitive vane is one that most readily assumes the wind-direction.

Professor Ferrel has discussed this question, from a mathematical stand-point, in the February number of the *American meteorological journal*. He assumes that the gyratory force ($gy$) of the wind upon a double-tailed vane varies as the square of the sine of one-half the angle between the tails, and gives the following expressions for the gyratory force. Let $i =$ one-half the angle of tails, $e =$ angle of deviation of wind, and $F =$ wind-force upon unit surface of vane: then we shall have, with $i > e$, $gy = F \sin 2i \sin 2e$; with $i < e$, $gy = F \sin^2 (i + e)$ in the case of a double-tailed vane, and $gy = F \sin^2 e$ with a flat vane. Professor Ferrel finds, that, with $2i = 90°$, there is a maximum sensitiveness of the vane. Without entering upon a discussion of the theory developed by Professor Ferrel, it may be suggested that we cannot neglect the great pressure that the tails at an angle of 90° would have to bear in a high wind, and which would come upon the axis. This amounts to ten pounds per square foot in a wind, forty miles per hour, impinging normally upon a surface. The angle of the sides being 45°, the total pressure would be somewhat less, but would still be sufficient to prevent all free action of the vane.

Mr. G. E. Curtis has also very recently given a theoretical discussion of the question before the Washington philosophical society, and in this he differs very materially from the one just given. He assumes that the action of the wind varies as the sine of its deviation angle. He gives for vane with double tails, $gy = F \sin (i + e)$ when $i > e$, and $gy = 2F \sin i \cos e$ when $i < e$; for a flat vane, $gy = F \sin i$. In the original formula $F$ is omitted; but I have supplied it, as it seems necessary. The notation is the same as in the previous case. There is a remarkable variance in these theoretical results, and it is a little difficult to state which is the more satisfactory. I hardly think that either can be accepted by the working meteorologist; but probably Professor Ferrel's is the more satisfactory, certainly for light winds.

No attention is paid in either of these discussions to the weight or friction of the vanes, yet it would seem as though either one of these is a far more important element than a single or double tail. In the discussion by Mr. Curtis we may very readily take these factors into account by placing the two tails of his double-tailed vane one above the other, edge to edge. We now have a flat vane whose weight, friction, and all other essentials are the same practically as those of the double-tailed vane; in fact, simply a transformation of the latter, without alteration except in the matter of surface. In fact, both vanes are directly comparable, while they were not before. We have, however, just doubled the surface of the flat vane, so that $gy = 2F \sin i$. Now, it is very easy to see that this expression has a greater value than $F \sin (i + e)$ when $i > e$, and also greater than $2F \sin i \cos e$ when $i < e$. This theoretical discussion, then, by Mr. Curtis, shows conclusively that the flat vane is the more sensitive. When we consider that Professor Ferrel regards the flat vane as much the steadier of the two, also that the

expense of manufacture and material is much less, it would seem as though it should be adopted, and attention turned to the weight, friction, shape of surface, etc.

Complaint is made of short, light vanes, that they often make a complete revolution in high winds. This could be obviated by increasing the weight, but this would not be as satisfactory as increasing the length. It is very evident that the same vane will not answer for both light and heavy winds. It would seem as though a long flat vane would do for the higher winds; and the lighter winds may be determined by the motion of smoke or a light banner, always being careful to keep the line of sight at right angles to the wind. This question is an eminently practical one. Experiments are much needed to determine the most satisfactory size of surface, length and weight of vane, for winds of different velocities, to satisfy the conditions first laid down.

Since writing the above, it has been suggested to me that the double vane can be so readily braced, it can be made out of very light material, and hence may be much lighter than the flat vane. The fallacy here consists in the implication that a single vane needs any bracing at all. Since there is no strain upon a flat vane, as it always turns immediately into the air-current, it need not be very stiff; but it is far otherwise with the double vane. Here the spreading of the tails at once brings a tendency to collapse, to each tail, which increases with the wind-velocity, and is never absent, being greatest when the vane is in the air-current. Each tail, then, must be far stiffer than the single tail, which has no strain at any time. But this is not all: the material used in the bracing will add much to the weight, especially with the greater angles of the tails. For example: take the most sensitive vane, where $2i = 90°$ and $e = 45°$. If the tails are 4 feet long, the spread at the tips will be 5.6 feet. A width of half a foot would give a strain of 30 pounds, with a wind-velocity of 40 miles per hour, and the tails must be very stiff. In addition, if the web bracing is as stiff as the tails, the total weight would be more than four times that of a single vane with double the surface and better fitted for service. H. ALLEN.

Philadelphia, March 15.

## On certain electrical phenomena.

There are a few mystics in science (I am not one of them), but I fail, even upon a second reading, to discover that shroud of mystery enveloping my letter 'On certain electrical phenomena' (*Science*, No. 211), which seems to have impressed my critic, 'T. C. M.,' in a subsequent issue (No. 213).

My letter was copied into a number of the daily papers in the eastern and western cities, and I have letters from people who are strangers to me, in regard to it; but thus far, excepting 'T. C. M.,' no one seems to think it 'mysterious.' I am sure I did not when I wrote the account.

Your correspondent further advises me that I should 'possibly eliminate a few of the facts' in making such investigations, to which I can only reply that I am not in the habit of eliminating any of the facts in the premises of any scientific investigation I may be engaged in, whatsoever may be its character. Usually I gather and use all such *facts* as I can lay my hands on.

As the point is an important one, I would also like to say to Professor Mendenhall that he evidently misquotes me in the next paragraph of his letter, wherein he says that "Dr. Shufeldt states that he had never observed such exhibitions in Washington." I made no such statement, but did remark that "I had never observed (there) such exhibitions so far as my own person was concerned, and they only gradually developed at this place" (Fort Wingate, N. Mex.). The cases cited for that city by him are very interesting.

I repeat, that in my case the "electrical discharge was considerably greater from the tip of the index-finger than from any of the others of the hand, and gradually diminished in regular order as we proceeded to the little finger;" and this after careful experimentation. I nowhere even imply that this will be found to be universally the case.

Further, your correspondent seems to hold the opinion that every one exhibits such electrical phenomena in the same degree, when submitted to similar conditions to excite it. In this I thoroughly disagree with him; for further experimentation here, goes to show that phenomena similar to those I described in my letter to *Science* are exhibited in varying degree by my three children, whereas on the other hand, in the case of the mulatto child I referred to, it has thus far, after numerous trials, been impossible to excite them in her.

And I must believe, that, when Professor Mendenhall comes to make more extended inquiry among a greater number of people, he will discover that there are many of them who have absolutely never heard of such things, to say nothing of having observed them in the case of their own persons. Common it is, no doubt; and, ah, me! how wise we would all be if we were but only thoroughly informed upon all common phenomena! R. W. SHUFELDT.

Fort Wingate, N. Mex., March 10.

## Comparative taxation.

It is true, as Mr. Atkinson says, that it is easier to criticise than to construct, and Mr. Atkinson deserves credit for his undertaking. Yet criticism of what has already been done may be of value in clearing the way for more perfect work in the future, and I therefore venture to offer a further criticism of some of the views expressed in Mr. Atkinson's letter of March 4.

Mr. Atkinson gives, as a reason for considering national taxation separately, the fact that in Europe so large a portion of the national revenue is expended for '*destructive* purposes,' by which I suppose is meant war purposes. The difference between Europe and this country is not so great as most people probably believe. If we consider the army and navy and pensions, which are a war expenditure, we find that in 1885–86 the German empire expended for the above purposes $110,500,784, and the United States $111,636,903. A comparison of the relation of these expenditures to total expenditures in the two countries is rendered difficult by the different character of the governments; but considering only the ordinary governmental expenditures, that is, omitting the consideration of railways, mines, etc., we find that in the United States war expenditures amount to 39 per cent of the whole; in the German empire, exclusive of the individual states, to 77 per cent; and in Prussia and the empire taken together, to 28 per cent.

Prussia and the empire together would form a fairer basis for comparison with the United States than would the empire alone, because the latter leaves the civil administration almost entirely to the individual states. The comparison with Prussia and the empire together, however, would not be exact, as in Prussia the nation assumes some functions which are here left to the states; but it is safe to say, that, if we could compare with accuracy the expenditures for like purposes in Prussia and the empire together and in the United States, it would be found that the proportions in each of war expenditures were nearly the same; and of course, if we consider the *productive* expenditures of the German states, the percentage of war expenditures will be much smaller than in this country.

I do not mean to deny Mr. Atkinson's general statement that a larger proportion of expenditures goes for war purposes in Europe than in the United States, nor to underestimate the other burdens which a great standing army imposes, but merely to point out, that, so far as state expenditure for war purposes is concerned, the difference between this and other countries is not so great as we are apt to think, and that in the case of Germany it is doubtful if whatever difference there may be is in our favor.

Mr. Atkinson also holds "that the revenue of state forests, mines, and other instrumentalities of subsistence . . . constitute as true a tax upon the people as if they had been assessed directly on their property."

That is a question that ought to be determined before we begin to make comparisons. If we intend to count profits from lands, mines, and railroads as taxes in Europe, we must do so in this country.

If the consumer is served equally well and cheaply by a private and public producer, profits are no more a tax in one case than in the other. It would be difficult to convince any one that it makes no difference to the German tax-payer whether governments derive from the profits of railroads a revenue sufficient to pay the interest on the public debts, as is the case in the German states, or whether that revenue comes from taxation, provided the railroads are as well managed as they would be if government did not control them. HENRY B. GARDNER.

Johns Hopkins univ., Baltimore, March 21.

## The characteristic curves of composition.

With regard to Professor Mendenhall's novel paper on 'The characteristic curves of composition,' in your issue of March 11 (No. 214), which proposes to represent and compare the orthographical productions of writers by a statistical and graphical method, it seems to me, that, interesting and instructive as are the results he has reached, they are confined to a range of inquiry too narrow to bring into sufficient relief the personal idiosyncrasies of individual writers, and to a kind of enumeration in which personal peculiarities are too much marked by the particular language in which they write.

That the characteristic curve is principally controlled by the language in which the composition is written, is evident from the comparatively small difference to be found between the various English writers between whom comparison is made, as well as from the marked departure from this general shape of the English curve to be seen in that of Caesar's 'Commentaries.' The curve found for any other Latin author would presumably not differ from this one more than the curves of various English writers differ from each other.

What the general shape of the characteristic curve may be for any writer is determined, then, principally by the language in which he writes.

It would be interesting to compare several languages with each other, so as to obtain approximately the normal curve for each. An inflected language, like Greek, Latin, or German, will, of necessity, have its normal curve largely affected by the numerous letters forming the terminations. Moreover, any tendency toward the formation of compound words, such as *Pferdebahnwagon*, or toward agglutination, would also have its effect upon the shape of the curve. Such a comparison would doubtless furnish tests on which to build new arguments and comparisons respecting the vexed question of Teutonicity, and the like.

But to return to the point with which I began; viz., that there are other characteristics of writers equally susceptible of treatment by the statistical and graphical method, in which their personal peculiarities differ more widely, and which are therefore more characteristic than the habitual selection and use of long or short words. For example: it seems to me that the length of the sentences employed by a writer is such a peculiarity, and one which, although influenced somewhat by the particular language in which he writes, is nevertheless an expression of his habits, feeling, taste, and individuality to such an extent as to exhibit necessarily some characteristics which would distinguish him in a marked manner from other writers.

The length of the adjective modifiers of substantives seems also to be a particular well suited to bring out individual characteristics by a similar enumeration. In this category may be mentioned also the length of the adverbial expressions; the complexity of the verbs; as well as the character of the vocabulary as regards derivation from Anglo-Saxon, French, Latin, Greek, etc. The list of fit subjects of enumeration can be extended at will.

It would seem probable that a discussion of the results obtained by the simultaneous application of several of these enumerations would, in any case of disputed authorship, afford decisive tests such as could not be obtained from any one of them singly; and by its help the person making the investigation could exhibit to the public how weighty the evidence may be on which his judgment is based.

H. T. EDDY.

Cincinnati, March 14.

## Earthquake weather at sea.

Your European exchanges have no doubt given you so full reports of the recent earthquake in this region, that it would be impossible for me to add any thing that would interest you or your readers. You may be interested, however, to have somewhat in as detail a report of earthquake weather at sea, such was encountered by the steamship Gottardo on its last trip from New York.

We sailed from New York on the 19th of February, and had disagreeable weather almost from the hour we left Sandy Hook. On Tuesday, the 23d, began a series of storms which kept by us almost constantly until we sighted the African coast outside the Straits of Gibraltar. The disturbance began about 4 P.M.

on that day, when we were in latitude 37° 32′ north, longitude 51° 26′ west of Greenwich. At that hour the barometer fell to 29.33; and the wind, which had been in the S.E., suddenly veered round to the S.W. and W. It increased in intensity very fast, and in an hour was blowing a whole gale, fully 70 knots an hour. The direction of the wind during this change was successively S.E., S.S.W., S.W., W., N.W., and N.N.W., and during the next twenty-four hours it was shifting back and forth from S.W. to N.N.W., with frequent squalls of hail and rain and a very heavy sea. The gale subsided the afternoon of the 24th, and the wind subsequent to the disturbance was quite steadily from the N.N.W.

The weather continued to be cloudy and squally, with frequent hail and rain and heavy sea; the barometer continued very low, and the wind strong from the N.N.W. and W.N W., until the 27th, when the wind veered to the W. and S.W., and remained in that quarter until the Azores were passed.

Early on the 1st inst. the wind shifted to the S.E. and E., with strong and heavy sea, and remained a steady head-wind, with cloudy and squally weather, until we were within a hundred miles of Gibraltar, the night of the 4th inst. At Gibraltar we learned of the earthquakes hereabouts and in the south of France, and were satisfied, that, if we had escaped the shock of the earthquake, we had had our share of earthquake weather. How far experienced observers may be able to connect our remarkable atmospheric disturbances at sea with the almost simultaneous quakings on land, I will not venture to suggest, but leave with you the record as it was made up at sea before we knew any thing of what was taking place on land.

At Gibraltar we learned that the western Mediterranean had been exceedingly stormy during the week following the earthquake, and it will probably be found that the atmospheric disturbance corresponded closely with that which we experienced at sea.

Henry D. Harrower.

Genoa, Italy, March 9.

## Notes on the diet of amblystomas.

All this past winter I have kept, in a little water in a small covered tin can, a large adult specimen of Amblystoma mavortium. Upon several occasions he has had the water about him freeze perfectly solid; and by accident he once remained in this condition, firmly fixed in the clear cake of ice, for a period of forty-eight hours. When spring came about, I removed him to a large and comfortable glass jar, with a heap of rocks in it for him to come out of the water and rest upon.

As he had not eaten any thing whatever for nearly five months, it struck me that he might have a good appetite for some raw meat. My suspicions were fully confirmed, for he ravenously devoured five pieces of lean beef in rapid succession, each piece being about as large as an ordinary lima bean.

Next day I could not get him to touch any thing, nor could he be tempted by the most delicate morsel of raw beef on the second day after his feast. The third day he seemed to me to be rather uneasy; and, believing him to be hungry again, I offered him a nice little piece of lean and raw mutton, as I had no beef. He at once snapped at it eagerly, taking the entire piece in his mouth. It was not there more than a fraction of a second, however, when his eyes began to roll in his head with a peculiarly horrified expression; and with a disgusted effort he immediately ejected the morsel of mutton again, and then took to spitting and gaping in a way that I never saw him guilty of before. There was no doubt in the world but that he was hungry; my several renewed efforts, however, to get him to eat the mutton, all failed.

So far as this individual specimen is concerned, he undoubtedly has a great aversion to that kind of meat, and it would be interesting to know whether this is merely 'a personal idiosyncrasy,' or whether it is universally the case. R. W. Shufeldt.

Fort Wingate, N. Mex., March 14.

## Old maps of the Great Lakes.

In looking over (for other purposes) some of the old maps in the congressional library, I have been struck with the confusion of ideas which seems to have prevailed among the early geographers on the subject of the drainage of the Great Lakes. Tracings of several are before me. One marked conjecturally on the original 'ab 1690' shows 'Lake Erius or Felis' connected by a good broad natural canal with the Potomac, which is represented as rising, at farthest, not much above the site of Washington. This is the harder to account for, inasmuch as the river-bank below, and the adjacent shore of Chesapeake Bay, were evidently well settled. Port Tobacco, Bristol, Calverton, St. Mary's, Arundelton, and Whitehall make a good sprinkling of villages, most of which have changed their names or passed away altogether; but a little beyond them all is twilight, with its illusions. So far as one can make out, the Anacostia or eastern branch is given the work of lake-drainage.

On a map of the world published in 1670 by Thornton of London, the Mississippi takes its rise in 'Grand Lake,' evidently Lake Superior. A map of America 'ab 1685' makes Lake Ontarius the source instead; and there is yet another, of which I made no note, that represents Lake Erius as discharging in the same manner and direction. All or nearly all of these geographers were aware of the St. Lawrence and its relations to the lake system, but they believed in a double drainage in very different directions.

A map ('ab 1690') of "New England, New York, New Iarsay, Pensilvania Maryland and Virginia, sold by Iohn Thornton at ye plass in ye minories" and others, is generally correct as to the outline of Chesapeake Bay and the tide-water part of the Potomac, but above the Little Falls it takes the name of Turkey Buzzard River. At no very great distance north of this point, this stream rises amid figures of trees and hills, with wild animals in the distance; but 'Lake Erius' is not called in to assist conjecture.

Wm. H. Babcock.

Washington, D.C., March 10.

## A meteorological inquiry.

Why do the winds at Denver blow either north or south nearly fifty per cent of the time, coming from the north during the day, and from the south by night? The record for 1884 shows twice as many south winds as north, but two observations are made at night to one during the day. H. A. Howe.

Denver univ., March 2.

### Publications received at Editor's Office, March 14-19.

CHALLENGER, report of the scientific results of the exploring voyage of the. Vol. ii.: Botany; vol. xvii.: Zoölogy. London, Government. Pl. 4°.

CONNECTICUT agricultural experiment station, annual report of, for 1886. New Haven, State. 168 p. 12°.

DREHER, J. D. Colleges north and colleges south. Salem, Va., Nat. educ. assoc. 21 p. 8°.

GATTINGER, A. The Tennessee flora; with special reference to the flora of Nashville. Phaenogams and vascular cryptogams. Nashville, The author. 109 p. 12°.

GREENE, E. L. Pittonia. A series of botanical papers. Vol. i. part i San Francisco, Cubery & Co. 49 p. 8°.

MASSACHUSETTS agricultural experiment station at Amherst, fourth annual report of the board of control of the, 1886. Boston, State. 136 p. 8°.

MENDENHALL, T C. A century of electricity. Boston, Houghton, Mifflin, & Co. 16°. $1.25.

NELSON, N. O. Profit sharing. St. Louis, Missouri republican. 40 p. 12°.

PUTNAM, S. P. The new God. New York, Truth-seeker co. 34 p. 16°. 10 cents.

RICKER, G. H. Elements of English: an introduction to English grammar. Chicago, Interstate publ. co. 100 p. 12°.

ROTCH, A. L. An account of the foundation and work of the Blue Hill meteorological observatory. Boston, Mudge. 29 p. 8°.

STOKES, A. C. Microscopy for beginners, or common objects from the ponds and ditches. New York, Harper. 308 p. 12°.

STORER, D. H. Agriculture in some of its relations with chemistry. Vol. i. and ii. New York, Scribner. 529+509 p. 12°. $5.

TEXAS state teachers' association, proceedings and addresses of the seventh annual convention of the. Waco, E. Kellner & Co. 77 p. 12°.

TRUTH-SEEKER annual and Freethinkers' almanac, 1887. New York, Truth-seeker co. 114 p. 8°. 25 cents.

TRY-SQUARE, or the church of practical religion. By reporter. New York, Truth-seeker co. 314 p. 16°. $1.

U. S. BUREAU of education. Circular of information No. 2, 1886. Washington. Government. 169 p. 8°.

### Calendar of Societies.

*Philosophical society, Washington.*

*March* 16. — A. S. Christie, On a problem in probabilities.

*Anthropological society, Washington.*

*March* 15. — James Mooney, The medical mythology of Ireland.

*Biological society, Washington.*

*March* 19. — L. O. Howard, A Rock Creek philanthropist; Charles Hallock, Transcontinental thoroughfare of the moose, with some description of its habits; Tarleton H. Bean, American and European work in deep-sea ichthyology; F. A. Lucas, The occurrence of Lepidoptera at sea; Joseph W. Collins, Some novel facts in the natural history of the codfish; C. Hart Merriam, Contributions to North American mammalogy; Description of a new mouse from New Mexico.

*Engineers' club, Philadelphia.*

*March* 5. — S. L. Kneass, A new fixed-nozzle automatic injector; R. W. Lesly, The manufacture of cements in the United States, and the growing demand for high-class mortars.

*Engineers' club, St. Louis.*

*March* 16. — Carl Gayler, Anchorage of suspension-bridges.

# SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 25, 1887.

## *SCIENTIFIC PHRENOLOGY.*

UNDER the above title the London *Times* reports an interesting session of the Anthropological institute, Mr. Francis Galton in the chair, at which Professor Ferrier read a paper on the 'Functional topography of the brain.' He discussed the question how far recent investigations into the functional topography of the brain could be brought into relation with craniological and anthropological researches with a view to establish the foundations of a scientific phrenology. Then he sketched the functional topography of the brain so far as it had been settled, but pointed out that the psychological aspects of brain-functions were still far from being made out, although that correlation must be established and proved before a practical psychology, in any degree serviceable to the physician or the anthropologist, could be regarded as possible. He offered some speculations on the subject, and illustrated them by reference to certain facts and phenomena of disease in man. On the question as to how far it was possible, from an anatomical examination of the brain, to form an estimate of the forces and capacities of the individual, he pointed out many great difficulties which had to be encountered. Not merely the size of parts had to be taken into account, but the relation of different regions to each other, the action of *metastasis*, structural differences, as well as other influences. *Caeteris paribus*, greater anatomical development might be considered as an index of greater functional capacity, all which points the lecturer illustrated in various ways. He thought the attempt to determine differences in functional capacity from the examination of the head involved all the difficulties connected with the examination of the brain, and a great many more. He indicated the cranial relations of the principal convolutions, but expressed his belief that in the present state of our knowledge the data of a scientific phrenology were still very deficient. There was reason to believe, however, that if the subject were taken up from different points of view by anatomists, physiologists, psychologists, and anthropologists, great progress might be made.

The discussion of the paper was opened by Sir James Crichton Browne, who detailed some very interesting electrical experiments he had made on the brain of a monkey, which clearly demonstrated localization of the cerebral functions. There were too often, however, insuperable difficulties to be met with in pursuing a parallel series of experiments on the living human brain. There were on record some curious accounts of investigations relative to the brain of a fowl by a bishop of Ratisbon in the thirteenth century, and in 'Burton's anatomy of melancholy' a good number of instances more or less like it were collected. It seemed to have been agreed that the number of the cerebral functions was thirty-five. To the early phrenologists a certain tribute of praise was due for their having, at least, called attention to the subject of craniological phenomena, although the quackeries of Professor Cagliostro and his rivals were simply beneath contempt. Boys were artfully trained to subserve the cunning exhibitions of such impostors. Still it must be allowed that the pseudo-phrenology in a certain sense paved the way for the cautious researches of the true science of a possibly distant future.

## *PSYCHOLOGICAL NOTES.*

THE January issue of *Mind* contains an account of an interesting series of experiments on the limit of the capacity to repeat a series of sounds after hearing them read once. A German experimenter, Ebbinghaus, had studied the powers of the memory by counting the number of times a given series of nonsense-syllables had to be repeated in order to enable the hearer to reproduce them by rote. Mr. Joseph Jacobs (with the co-operation of Mr. Sully, Mr. Read, and Mrs. Bryant) has carried a similar means of testing the memory (or, as they more accurately call it, the 'prehension') into the school-room. The method was somewhat simpler. Instead of nonsense-syllables (for instance, *dak-mil-tak-bin-roz*), which are very disturbing, the names of the letters (omitting 'double *u*') and of the numerals (omitting 7) were chosen; and the maximum number of letters and numbers that a child could repeat after *one* reading was called its 'span.' Care was taken to pronounce the words as monotonously and as regularly as possible in order to avoid any assistance to the memory from a more or less decided rhythm. The numbers or letters were dictated to the class, each member of which then (usually) wrote down as accurately as possible the series of letters or numbers. The results thus reached were quite interesting.

The mental span increases quite constantly with the age. Boys of 11 years could grasp 6.5 numerals and 5.5 letters; of 12 years, 6.8 numerals and 5.7 letters; of 13 years, 8.8 numerals and 6.9 letters. The following table shows the result of a more extended set of observations on the girls of the North London collegiate school:—

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Number of subjects | 8 | 13 | 19 | 36 | 41 | 42 | 42 | 72 | 66 | 50 | 30 | 14 |
| Average number of numerals | 6.6 | 6.7 | 6.8 | 7.2 | 7.4 | 7.3 | 7.3 | 7.7 | 8 | 8 | 8.6 | 8.6 |
| Average number of letters | 6 | 7 | 6 6 | 6.4 | 6.5 | 6.7 | 6.7 | 7.4 | 7.9 | 7.3 | 8.2 | 7.9 |

While the limit for numerals was, as a rule, higher than that for letters, cases when the reverse was true were not infrequent. In one set of 88 schoolboys, 14 could repeat more letters than numerals, while 33 of the remainder had the same limit for both. No definite conclusions can be drawn as to the relative spans of the two sexes, as the boys and girls came from different classes of society. It may be worth noting, that, at the age of 13, the boys could repeat 8.8 numerals to the girls' 8.3, but only 6.9 letters to the latter's 7.3.

A very clear result was, that the span bore a definite relation to the rank in the class. Thus, the 10 boys who stood highest among 30 twelve-year-olds had an average span for numerals of 9.1; while the middle 10 had only 8.3, and the lowest 10, 7.9; and the same holds for the girls. The first half of a class almost invariably shows a higher span, both for letters and for numerals, than the second half.

Mr. Francis Galton and Professor Bain applied a similar method of observation to the memory-powers of idiots. While most idiots can hardly add two figures together, some have a decided knack for remembering figures, dates, and so on. Nine of the best girl-idiots at an asylum (none of whom could add 3 to 5) had an average span for numerals of only 4. Two girls who could not repeat more than two figures without mistake were tested with three figures. In 23 trials the last figure was rightly repeated 17 times, the second 10 times, and the first 7 times, showing that the last-uttered sound is most readily repeated.

Idiots with peculiar memories were also tested. One could repeat pages of Maynall's 'History' with considerable exactness; another had a remarkable intimacy with the calendar. But they all failed on the numeral test, being hardly able to repeat three figures. Their memories seemed deeply rutted in one groove; not strong, but very limited.

The experiments on the idiots of another asylum showed a somewhat higher mental span, accompanied by a higher capacity generally.

In the same journal, Dr. J. M. Cattell records some 'Experiments on the association of ideas. His object is to measure the time needed for the characteristic processes of ordinary thinking. The experiments were made on himself and a German friend, Dr. Berger. A few of his results are these. To give the name of the picture of an object in a foreign language (English for a German, and German for an American) required .649 and .694 of a second respectively, which is .172 and .149 of a second longer than to name objects in one's own language.

Experiments on the time necessary for translating words showed that it took longer to translate from the foreign to the vernacular than the reverse, and also that the time itself might indicate one's familiarity with the two languages.

Given a city to name the country in which it is situated required about .400 of a second. Given a month to name the following month required .367 of a second, while to name the preceding month took as long as .798 of a second, showing how much more readily the mind moved forwards than backwards. Similarly, it is easier to proceed from the part to the whole than from the whole to the part. Given a month to name the appropriate season requires .363 of a second; given a season to name a month in it, .498 of a second.

When the association is less restricted, — as, for instance, to name a subject for an intransitive verb (*swim – fish*), or an object for a transitive one (*write – letter*),— the time is longer. The former operation took .646 of a second, and the latter .517, the mind moving logically towards the object.

The time necessary to judge the length of a line suddenly revealed was very long (nearly one second), showing that the judging process forms slowly.

It is, however, to be remembered that in all the above processes individual variations are extremely large. While such experiments are rather suggestive and personally interesting, they can hardly be said to have the scientific character or importance belonging to the measurement of more elementary processes. There is little guaranty that the process in different minds is sufficiently alike to make an average significant.

## CURRENTS IN THE BOSPHORUS.

CAPTAIN MAKAROF of the Russian navy has given an account, in the Sapieski of the academy at St. Petersburg, of his observations on the currents of the Bosphorus, made between November, 1881, and August, 1882, which reaches us through the highly valued *Annalen der Hydrographie* of the German admiralty. The surface current, from the Black Sea to the Sea of Marmora, follows the windings of the strait, with occasional backset eddies near the shore: its velocity averages two knots an hour, and reaches a maximum of four knots. The velocity has a maximum in summer corresponding to the higher level of the Black Sea in that season and a faint maximum about noon, supposed to be due to the diurnal increase of the north-east wind. The undercurrent carries the denser water of the Mediterranean into the Black Sea: its water has a specific gravity of 1.02834, while that of the surface is 1.01534. The plane of contact of the two has a greater inclination towards the Black Sea: at Constantinople it is twenty metres under the surface: at the north-eastern end of the Bosphorus it is fifty metres deep. This is shown more in detail in the following table: —

| Distance from Black Sea. Kilometres. | Contact plane. Metres. | Depth of water of sp. gr. 1.020. | Depth of water of sp. gr. 1.025. |
|---|---|---|---|
| 0 | 50 | 45 | 49 |
| 9 | 43 | 39 | 42 |
| 20 | 36 | 33 | 37 |
| 23 | 42 | 25 | 27 |
| 29 | 20 | 25 | 24 |

There appears to be a variation in the depth of the contact plane with the seasons, but it is to be remembered that this depends on only one year's observations. At nine kilometres from the Black Sea, water of a specific gravity of 1.0225 was found in the middle of June at 43 metres; at the beginning of July, 41.5; end of July, 40.5; end of August, 34.7 metres. It is suggested that this variation depends on the height of the water in the Black Sea. The greater its height above that of the Sea of Marmora, the less the difference of pressure at the bottom of the strait, and thus the less cause for the deep counter-current. The velocity of the upper current is greatest at the surface; at the limit between the two currents, the two velocities just counteract each other; the maximum velocity of the lower stream is found at five and a half metres below this neutral surface. By considering the mean velocities and cross-sections of the two currents, it is estimated that the Bosphorus annually carries 152 cubic kilometres of water from the Black Sea.

## MENTAL HYGIENE.

ONE important element that contributes to the high position that Germany occupies in the world of science is the existence of a large class of scientists devoted to a specialty, but with an intelligent and cultured interest in many topics lying more or less remotely outside their own branch. In this way an appreciative public is guaranteed for an 'atechnical' treatment (to use Hamerton's word) of one's own specialty. This is synonymous with the good sense of the word 'popular,' but it is the very opposite of much that goes by that name here. It is a concise and easy treatment of a subject, without neglecting the difficult points, or sifting out the interesting things to be served in a highly diluted form. Another enviable peculiarity of German science closely connected with the former is the ability to treat a subject from (there is no better word for it) a philosophic point of view; to bring it into relation with the questions that always have interested and always will interest mankind. As the physicians everywhere form the largest body of professional scientists, it is an especially enviable state of things when all this (as it is in Germany) is true of them. An excellent illustration of this fact is shown in this book by Dr. Schulz. He is writing upon his specialty in a perfectly clear and yet entirely scientific manner, feels confident of finding an appreciative public, and has shown an important connection between the teacher and the doctor.

The problem of civilization is to the alienist the problem of keeping sane. At no time was optimism so justifiable a faith as it is now. Comfort, liberty, philanthropy, education, and all the aids to happiness, are more wide-spread now than ever before. And yet we do not enjoy our happiness. Discontent is found everywhere. Why is this? Primitive man used muscle and nerve as his chief tools, just as we do; but formerly it was the muscle, now it is the nerve, that has the most to do. The work that modern culture demands is, above all, brain-work. The higher the civilization, the more the brain has to do. This delicate organ has become overtaxed. The onward march has been too rapid to give us time to get fully adapted to our surroundings, and an intense struggle for existence is the result. In this struggle many fail, and hence our age is called an 'age of nerves' (*nervöses Zeitalter*): hence the alarm-

*Die Diätetik des Geistes.* Von Dr. FRIEDERICH SCHULZ. Leipzig.

ing increase of nervous and mental diseases. Thus it is that the problem of keeping sane becomes the problem of civilization: civilization is the cause of mental weakness as well as the result of mental strength.

The two factors that have of late come into greatest prominence in this connection are the use of stimulants and the universal applicability of the laws of heredity. The fact that these come first is a sufficiently suggestive text to which the sermon can readily be added. Dr. Schulz looks forward to the time when these truths will be incorporated into social morality, and imprudent marriages be placed in the same category with criminality.

It is more true of nervous than of any other diseases, that the ideal to be aimed at is not so much to cure them as to prevent them. In the work of prevention it is the parent and the teacher who can do the most. The ancient phrase that calls the teacher the doctor of the mind is more than a metaphor. The doctor and the educator are at work upon the same problem. What the latter does is taking so much of a load from the shoulders of the former, and in the next generation the debt is repaid. And still more is this true of the parent. Our increased knowledge of nervous and mental diseases enables us to recognize their incipient stages when they can be checked from further development. That no one is perfectly sane is a commonplace. What it means is, that each one detects in himself latent tendencies in one direction or another, which, if they remain unchecked and are left to develop freely, would become morbid. A normal, rational life cures these tendencies of itself. They are absorbed in the growth of character. Yet it is very necessary to remember that our insane fellow-man is not made of different material from ourselves; he has simply elaborated one of the factors of life at the expense of all the others, and has thus lost his mental equilibrium: and it is also well for teachers to know as much of the nature of such tendencies as can be acquired from the reading of such a book as this.

The mental life of children presents problems peculiar to itself. We are beginning to take the step from the empirical to the scientific statement of these problems. We are learning to see things from the child's point of view; to appreciate how very intimate is its mental connection with its physical well-being; to know that education does not mean instruction; and, above all, the awful significance of that period of life when the boy or girl becomes a man or woman is recognized as the key to all higher character-building. Whatever may be said against the materialistic tendencies of our day in other directions, in the field of education it has introduced wonderful reforms. In the school-room it has banished the middle ages and rationalized methods.

Enough has probably been said to show the point of view from which mental unsoundness is treated in the works of which this is a good type. It is an anthropological study of brain-culture. It describes the morbid tendencies in mental development, and thus gives additional knowledge of the normal mind; and, finally, it brings the problems of modern civilization to a focus where they can be studied and practically thought out for the benefit of the races to come.

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## *ECONOMICS, SCIENTIFIC AND POPULAR.*

*The economics of industry.* By A. and M. P. MARSHALL. 3d ed. New York, Macmillan. 12°.

THE wide-spread interest in the prominent economical questions of the day has brought forth new editions of two English works which are in different ways most timely and useful. The 'Economics of industry' well deserves the honor of a third edition. As professing to solve the problem of distribution in a scientific manner, it is of course especially interesting in its bearing on the controversy now flagrant between the old and the new school of economic thought. The authors do not formally array themselves with either of the antagonists. By casting some of the most distinctive doctrines of the new school into a purely scientific form, they refute the charge that the modern theories remove economics from the category of sciences. On the other hand, they are far from rejecting the system and methods adopted by the great expounders of the old school. The purpose of the volume is expressly declared to be a completer development of the theory of value, wages, and profits as propounded by John Stuart Mill. It is well known that Mill was, of all the older school of economists, the least inclined to consider its conclusions absolute and final verity. Nothing could be more natural, therefore, than to use his work as the foundation for a more modern superstructure. Our authors contribute much, indeed, to the elucidation of the truth that the new economics, which its younger and more enthusiastic devotees are apt to hail as an inspired creation, is in reality only a growth. It is the flowering and the fruiting of the symmetrical but in many aspects repulsive stalk which has hitherto been all that the world could see of political economy.

The influence of the modern tendency manifests itself at the very outset by a broadening in the definition of the fundamental concepts of the science. Wealth, for example, is made to include

non-material possessions as well as the tangible utilities. A larger scope in the conception of capital is, of course, the necessary corollary. The ordinary analysis of capital is, furthermore, improved by the division into 'specialized' and 'non-specialized,' depending upon the degree of difficulty in diverting it from one trade to another; and convenience in phraseology is enhanced by distinguishing between 'remuneratory,' or 'wage-capital,' and 'auxiliary capital,' or that employed to aid the labor which the first supports. In such a spirit of broad definition and logical distinction, book i. of the 'Economics of industry' presents the ordinary doctrines of land, labor, and capital with clearness and conciseness.

Book ii. treats of normal value. Here, with most painstaking care, is elaborated the theory of value and the solution of the problem of distribution which especially distinguishes the modern economy. In the theory of value, the old lines are generally followed, save in the more or less important substitution of 'normal value' for the concept which has become familiar as 'natural value.' The discussion of distribution, however, reveals a departure from old standards at the very outset. Instead of the ancient assignment of the product of industry to the various classes of rent, profits, and wages, we find a division into rent, earnings, and interest. In accordance with a principle that is characteristic of the new school, the *entrepreneur* class is differentiated from the capitalists, and its share of the produce is grouped with the wages of labor rather than with the wages of abstinence. The law fixing the rate of interest is accordingly worked out as the sole determinant of the capitalist's share of a product, while the profits of the employer of labor are assimilated in treatment to the income of skilled wage-earners. The justice and logic of this arrangement cannot be questioned. The industrial revolution which began last century, and may not yet have culminated, has certainly evolved a new economical factor. As Walker says in his work on wages, "It is no longer true that a man becomes an employer because he is a capitalist. Men command capital because they have the qualifications to profitably employ labor. To these captains of industry (or organizers of industry), capital and labor alike resort for the opportunity to perform their several functions." The tendency of this class to increased importance is well illustrated by the demonstration of the principle that those who, with little or no capital, depend upon their business profits for a livelihood, undersell and drive out of trade those who, having capital, undertake the management of industry merely to increase their income (pp. 136, 137). Modern production has, in short, attained that stage where ability without capital has a much fairer hope of great rewards than capital without ability. It would be useful to have this fact instilled into the minds of the masses who are constantly complaining about the 'capitalists.' The chapter entitled 'Earnings of management,' in the book under review, contains a most admirable investigation of the nature and functions of the *entrepreneur* class.

It was to be expected that an author of modern economic propensities would touch up that *bête noir* of the new school, the wages-fund theory. We find this subject buried in the depths of the chapter on trades-unions. The authors are rather inclined to adopt the position of Mill in his later days as opposed to the bald doctrine of the extreme old school. Jevons and all the other lights of the new school throw themselves unreservedly upon the doctrine that wages and profits can increase simultaneously; in short, that the law of supply and demand operating in the respective classes determines wages of labor and wages of management. The Marshalls appear unwilling to go thus far; but they emphasize the idea that the efficiency of labor as well as the amount of antecedent capital exercises a potent influence upon wages. Trades-unions, they think, may enable laborers to obtain a general increase of wages, which, however, will only be permanent if attained by means that do not seriously hinder production, and if used in such a way as largely to increase at least the personal capital of the laborers, and so to add much to their efficiency (p. 203).

*The wealth of households.* Danson. Oxford, Clarendon pr. 12°.

In striking contrast with the scientific spirit that pervades the volume just discussed, is the air of breezy popularity that characterizes 'The wealth of households.' Why the author chose to disguise a treatise on political economy with such a title is an unsolved mystery. We hazard the conjecture that the reason might be found in the same trait of Mr. Danson's mind which has led him to turn the customary order of economic discussion all topsy-turvy, while not aiming at any novel result. His book was originally concocted for the benefit of his children. This probably explains the division of the text into numbered paragraphs of an average length, that suggests a second or possibly a third reader, and on a principle of logical connection that has no parallel outside of the authorized version of the Bible.

The intimation in the preface is not necessary to assure the reader that Mr. Danson has been a 'man of business.' Nor is it difficult to guess the special line he was in. The able, vigorous, and

reiterated defence of the usefulness of the 'dealer' or middleman in the economical structure of society might, but probably would not, have been penned by any one but a commission-merchant. As might be expected, the author's practical training produces the best results in those parts of the subject where a personal concern in affairs is essential to a thorough understanding. His chapters on banking, commerce, and credit are clear and incisive. There is no striking novelty in them, but the fresh and vigorous style clothes the old ideas with a living interest. In his treatment of the fundamental definitions and generally accepted principles of scientific economics, Mr. Danson is in many respects rather original than convincing. While deprecating the confusion that arises from the use of the same term in different meanings, he defines 'profit' in an entirely novel manner, and, on the strength of this, goes on to combat the theories of profit that have been proposed by economists who retain the old definitions. He maintains that profit is earned only by risk : it is therefore inseparable from capital. The manager who conducts business on borrowed capital receives only wages ; for the lender risks the loss of his capital, and the additional rate of (so-called) interest he receives to cover the risk is really the 'profit.' On this theory, it is evident that Mr. Danson would limit the term 'interest' to the remuneration for loans on which the security is absolutely perfect, or, in general, to a purely hypothetical quantity, and would use 'profit' principally to denote the income of insurance companies. We doubt that economists generally will follow him.

'Rent' is another term in respect to which our author courts originality. He regrets the variety of meanings assigned to the word, and proceeds to mend matters by setting forth an entirely new one. We shall not follow him in his career. Ricardo will doubtless survive the latest sceptic's assault. The result of our author's doctrine is wrought into a radically conservative view of the modern land-question. Henry George is neatly annihilated by a demonstration of the fact that there is no such a thing as an 'unearned increment' in the value of land. The general treatment of the land-question indicates a probability that some of the profits, or rather 'wages,' of the commission-merchant have found investment in an English estate.

On the labor and wages question, Mr. Danson cleaves to the old school. The interests of labor and capital are identical, and all that the laborers have to do is to eschew trades-unions and become millionnaires as soon as possible. Inspection-laws for factories, like poor-laws, are inherently vicious, and, in general, *laissez faire ;* some of which sentiments indicate that a Liverpool commission-merchant feels under no necessity of advancing merely because the rest of the world does.

WM. A. DUNNING.

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## SOME RECENT MINERALOGICAL TEXT-BOOKS.

*Manual of mineralogy and petrography.* By JAMES D. DANA. 4th ed. New York, Wiley. 12°.

THE well-known manual of Professor Dana appears in much its former guise, but with such alterations as are needful to keep it abreast of the progress made in mineralogical and petrographical science during the nine years which have elapsed since the publication of the third edition. The old arrangement is preserved throughout, which will prove acceptable to those who are already familiar with the book. It is only intended for an elementary treatise, for the use of schools or of the practical miner and geologist: hence the arrangement of the species according to their principal metallic base is advantageous. The full list of American localities and the tables for determining minerals are also valuable addenda. The chapter on rocks has undergone extensive changes. The terms 'petrography' and 'petrology' are preferred to 'lithology,' which was formerly used. The various grounds of classification are stated, and the rocks divided into, 1°, calcareous ; 2°, fragmental, not calcareous ; 3°, crystalline, not calcareous. The arrangement of the members of the last class is much like that of Rosenbusch. The banded and schistose varieties are classified with the massive ones, but they are for the most part considered 'metamorphic,' by which term the writer seems to imply that they are altered sediments. The metamorphism of eruptive rocks into schists seems hardly to have secured recognition. Altogether the book is increased by only forty-three pages, but its many improvements will secure it a welcome among all teachers.

*Tables for the determination of common minerals.* By W. O. CROSBY. Boston, J. A. Crosby. 8°.

Professor Crosby's tables are intended to aid beginners in the identification of the commoner minerals, chiefly by means of their more apparent physical properties, and then to show them how the determination may be confirmed by simple chemical tests. The classification is, 1°, according to lustre (metallic and non-metallic): 2°, according to the color of the metallic, and the streak of the non-metallic minerals ; and, 3°, according to the hardness. In this way forty-one classes are formed, which are further subdivided in the analytical key by specific gravity, texture, crystal form, cleavage, etc. The method is the result of

five years' practical experience, and must possess great advantages for the class of students for whom it is intended.

*A catalogue of minerals alphabetically arranged.* By A. H. CHESTER. New York, Wiley.

Professor Chester's catalogue is best described by an extract from its preface: "This list is intended to embrace all English names now in use in the nomenclature of mineralogy. It includes species, varieties, and synonymes. Well-authenticated species are put in full-faced type. Dead and useless names have been omitted, so that the catalogue can be conveniently used as a check-list and in cataloguing collections." The list seems very complete, and admirably adapted for purposes stated by its author. G. H. WILLIAMS.

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## THE CHEMISTRY OF THE SUN.

MR. LOCKYER'S new book is unquestionably the most important work in the department of astronomical physics which has appeared for several years: it is especially interesting and valuable as coming, not from a compiler and dealer in second-hand materials, but from an original worker, who has himself made most of the observations and investigations on which his conclusions depend. We do not mean, however, to imply that he either ignores or is ignorant of the work of others, or fails to make proper use of it: in fact, he brings together a very complete account of all that bears upon his subject, with due credit to his fellow-workers and a generous appreciation of their labors and opinions, even when their conclusions differ from his own.

While the book can perhaps hardly be called a 'popular' exposition of its subject, it is certainly not *un*-popular, — not unnecessarily technical or abstruse; and the vivid, enthusiastic, perhaps here and there just slightly sensational, style of the author helps to make it attractive: so that it seems likely to be far more extensively read than most volumes of its class.

The main purpose of the writer is to present the spectroscopic evidence in favor of the hypothesis that our so-called elements are not truly elementary, but so constituted that they can be broken up, or 'dissociated,' into still more elementary components by the action of heat; and that on the sun and stars they are actually so dissociated by the high temperatures there prevailing.

In the preface, after pointing out the decomposing power of higher and higher temperatures as actually observed in our laboratories, the author adds as a sort of summary of his argument, "The question then, it will be seen, is an appeal to the law of continuity, nothing more and nothing less. Is a temperature higher than any yet applied to act in the same way as each higher temperature which has hitherto been applied has done? Or is there to be some unexplained break in the uniformity of nature's processes?"

*The chemistry of the sun.* By J. NORMAN LOCKYER. New York, Macmillan. 8°.

The first seven chapters of the twenty-eight which make up the book are mainly historical, occupied with an account of spectroscopic work previous to 1866, and giving perhaps the best *résumé* of the work of Wollaston, Fraunhofer, Kirchoff, Angstrom, and others, that can be found in the same space. The next three chapters discuss what the writer calls 'A new method in spectroscopy,' and its results. The 'new method' consisted merely in attaching the spectroscope to a telescope, and studying the spectrum of an object in *detail*, instead of in gross, so to speak. Huggins seems to have been the first to employ this 'new method' in his examination of the nebulae in 1864; but Mr. Lockyer was the first to employ it upon the solar surface in 1866.

The results were the recognition of many peculiarities in the spectra of sunspots and faculae, the development of the method of observing the chromosphere and prominences without an eclipse, and the detection of remarkable modifications of many lines in the spectrum, such as widenings, reversals, contortions, etc., all significant and evidently depending upon the physical conditions of temperature and pressure prevailing at that special point of the solar surface which happens to be imaged on the slit of the spectroscope at the moment of observation.

This is followed by an account of the author's early laboratory-work, especially his investigation of the so-called 'long and short lines' in elementary spectra, and the coincident lines in different spectra. This brings us down to 1873.

The next three chapters discuss the 'difficulties' that had presented themselves, and seemed to require a remodelling of the received theories. Our space does not permit a presentation of these difficulties here; but it must suffice to say that they are such as absolutely to compel us to suppose that a given element, such as iron for instance, either gives widely different spectra under different circumstances, the spectrum tending towards simplicity under the very highest temperatures, or else that it is decomposable.

This idea, that our elements are only relatively elementary, while really composed of still simpler substances, is no new one, as Mr. Lockyer himself points out, but had previously been brought forward, and more or less strongly advocated, by Dumas, Brodie, Sterry Hunt, and others, though not on spectroscopic grounds.

The succeeding chapters give us an account of the author's elaborate photographic study of the solar and metallic spectra, a fuller statement and discussion of the dissociation hypothesis, and a comparison of it with certain test-experiments and with the observations that have been made upon the spectra of sunspots and of the chromosphere.

The twenty-fifth chapter deals with the results deduced from the observations of recent eclipses; the twenty-sixth is devoted to the 'basic lines,' to which the author still clings with something like a parent's tenderness for a feeble child; the twenty-seventh deals with the spectroscopic phenomena of the electric arc; and the twenty-eighth and final chapter gives a sort of summing-up and general application of the hypothesis to the phenomena of solar physics.

As to the 'basic lines,' which if really existent would amount to something hardly short of a demonstration of the dissociation hypothesis, the author frankly concedes that the apparent coincidences between the lines of different metals are not exact when examined with sufficient dispersion, but he maintains that the near approach to coincidence is hardly less significant, and appeals to the observations of lines affected in the spectra of sunspots and prominences to show that the 'basic lines' are essentially different from other lines. It is certainly true, that, as compared with other lines, these 'basic lines' are observed with very disproportionate frequency and intensity; but to most spectroscopists it appears that a sufficient explanation exists in the fact that each of them is double or multiple, having each of the components separately affected. In most cases the thickening or reversal of a line is a very delicate phenomenon, difficult to make out at best; and, when two or more such lines happen to stand close together, they catch the eye more readily: probably that is all.

Taking the whole work through, it may be said, that, while here and there passages are open to obvious criticism and objection, Mr. Lockyer undoubtedly makes out a strong case in favor of his 'dissociation hypothesis' by showing its accordance with the phenomena of the solar and stellar spectra. At the same time the alternative hypothesis that an elementary molecule, *without breaking up*, may, after the analogies of allotropism, be capable of very different modes of vibration under different circumstances of pressure, density, and temperature, and so give entirely different spectra, — this hypothesis seems equally reconcilable with observed facts. And it does not encounter the difficulties, which Mr. Lockyer barely alludes to, that our present chemical elements seem to be set apart from all compound bodies by Dulong and Petit's law of atomic heats, and Mendeljeff's periodic series. Until this difficulty is overcome, — we do not mean to imply that it is necessarily insurmountable, — we doubt whether most physicists and chemists will be disposed to abandon entirely the hypothesis of 'multiple spectra' for that of 'dissociation.'

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PROFESSOR LEIDY, in the *Journal of comparative medicine and surgery*, communicates his observations on the subject of tape-worms in birds. He finds that birds are as much infested with intestinal worms as other classes of animals, and that none appear to be exempt, no matter what may be the nature of their food, though aquatic birds appear to harbor a greater number of species, as exemplified by ducks and geese. Among the parasites, tape-worms — mostly of the genus Taenia — are common, though less so than the thread-worms. The domestic fowl in Europe has been reported to harbor half a dozen different species of Taenia, though Leidy has observed but one in our domestic fowl, and this but rarely. In the turkey, guinea-fowl, and pea-fowl, no species has been observed. In the sage-fowl (Centrocercus urophasianus), tape-worms are often found in large numbers, sometimes so as to distend the intestines: the species seems to be Taenia microps Diesing. The reed-bird or rice-bird (Dolichonyx oryzivorous) is also infested with tape-worms (Taenia pestifera). Leidy has found that in a bunch of a dozen obtained in the Philadelphia market three or four individuals will contain this parasite. The thin birds are the ones especially affected, the fat ones being commonly exempt. Tape-worms have also been found in the yellow-breasted chat (Icteria virens), the cow-bird (Molothrus ater), the quail (Ortyx virginianus), the chuck-wills-widow (Antrostomus carolinensis), the blue heron (Florida coerulea), the robin (Turdus migratorius), the woodcock (Philohela minor), and in the horned grebe (Podiceps cornutus).

— Dr. Wilcox of Washington, D.C., writes to the *Medical record* that the cow-boys of Idaho treat animals affected with 'loco' poisoning, to which he has already referred in *Science*, by amputating the tails of the affected animals. The paralysis is due to congestion of the spinal cord, the posterior parts of the body being first affected. The plants which are charged with producing this poisoning are Oxytropis Lambertii, Astragalus mollirimus, and possibly others of the leguminosae. The cow-boys call these plants 'larkspur,' although true larkspur is not found in their line of march, nor at the season when loco-poisoning occurs.

# SCIENCE.

FRIDAY, APRIL 1, 1887.

## *COMMENT AND CRITICISM.*

THE *résumé* of the evidence concerning thought-transferrence which Dr. Morton Prince of the Boston city hospital drew up for presentation to a medical society, and which is now reprinted in pamphlet form, seems to us eminently judicious. It embodies such a judgment on this interesting but exceedingly difficult subject as an intelligent man who has carefully studied the evidence, and is competent to weigh it, may now fairly hold. Dr. Prince begins by hastily narrating the salient points in the history of the Society for psychical research, and then summarizes the Creery experiments, those with Messrs. Smith and Blackburn, and those carried on by Mr. Malcolm Guthrie, all of which are by this time familiar to American readers, an article recounting them having appeared in the *Popular science monthly* for August last. The evidence adduced by the above-named and similar experiments is, according to Dr. Prince, as follows: First, we have as experimenters a number of gentlemen noted for their integrity, and whose standing would exclude all intention at deceit on their own part. Second, the experimenters, after considerable previous experience, arrange the conditions of the experiments so as to exclude by every possible device all possibility of communication by the ordinary channels, including collusion. They are allowed to arrange the conditions according to their own option in such a way as to test in the most stringent manner the phenomena under investigation. In this way the experiments differ essentially from those made with ordinary professional spiritualists and mind-readers. Under these stringent conditions, results are obtained showing that the thoughts of one mind have been communicated in some way to another. Third, the experimenters conclude that the communication has been made by direct thought-transferrence.

Dr. Prince, in commenting on this summary of the evidence, says that the opinions of the experimenters themselves are of undoubted value, but that overlooked sources of fallacies may yet appear. The phenomena in question cannot be established beyond the possibility of a doubt until both observers and subjects have been very much multiplied. The opinions held by Dr. Prince himself as to the evidence seem to us amply justified by the facts. The opinions are these: 1°. All the evidence *that we possess, such as it is*, goes to prove that certain persons, under certain favorable conditions, can become cognizant of the thoughts of another without any communication by the senses; 2°. That the best *working* hypothesis that we possess is in favor of direct thought-transferrence as an explanation; 3°. *A priori*, there is nothing inherently impossible or improbable in the hypothesis; 4°. The subject must be considered as still *sub judice*, and needs further investigation to settle the question beyond possibility of doubt. Dr. Prince disposes very neatly of those critics who would set aside the evidence gathered in England because from time immemorial similar claims have been made by spiritualists, clairvoyants, and the like. He calls such objections illogical and unscientific, for there is not the slightest parallel between the two cases. "No physical experiments in the laboratory have been more under the control of the chemist and the physiologist than have these. The subjects have given themselves up to the experimenters, not occasionally and fitfully, but day after day. Any and every sort of condition has been cheerfully acquiesced in and imposed." Dr. Prince concludes his interesting paper by cautioning all persons against confounding the evidence for thought-transferrence with the muscle-reading of the professional 'mind-readers.' The more the intelligent public hears about thought-transferrence, the more it is convinced that a conclusion is going to be reached by a study of the evidence solely, and not by abuse and sarcasm aimed at the gentlemen who are giving their time, their labor, and their money to these investigations.

IN 1883 A COMMISSION was appointed in Germany to consider and report on the advantages and disadvantages of vaccination. In the commission were three anti-vaccinationists. The following are among the conclusions reached by the commis-

sion, whose report has recently been made. The length of time for which vaccination protects against small-pox varies greatly in different persons, but in the mean it is about ten years. 1°. Re-vaccination is necessary ten years after the primary operation; 2°. Two well-marked vesicles are necessary to insure a successful protective vaccination; 3°. There is no evidence as to any increasing special disease or of general mortality which can be considered as due to the introduction of vaccination; 4°. The use of animal vaccine is preferable; 5°. Vaccination should not be performed while scarlet-fever, measles, diphtheria, whooping-cough, typhus, or erysipelas are epidemic or unusually prevalent in the neighborhood: 6°. Infants should not be vaccinated before they are three months old unless small-pox is prevalent in the vicinity; 7°. The greatest care as to the cleanliness and disinfection of the instruments used for vaccination should be insisted on.

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We heartily indorse most of these views and recommendations. The objection to vaccination during the prevalence of communicable diseases, with possibly the exception of erysipelas, is, we think, not a valid one. If any of these diseases exists in the family where there are children unprotected from small-pox, vaccination should undoubtedly be deferred until the danger of contagion is passed. But in our large cities these diseases are so continuously present, that, if vaccination were to be postponed until they disappeared, we fear the operation would never be performed, and we should soon have a vast amount of susceptible material which would furnish a rich field for the propagation of small-pox. The admonition in reference to the care of the lancet is well-timed and important, and is a precaution which is too apt to be overlooked, both in private and public vaccination. Passing the lancet through an alcohol flame will accomplish the object in a perfectly satisfactory manner, or, if the vaccine-point is itself used to scarify, the danger is equally avoided.

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CRUDELI, AS THE RESULT of a long observation of malaria in Italy, finds that while a certain amount of moisture is necessary for its development, yet it is by no means confined to swampy and low regions, but is often met with in elevated regions. In a recent discussion of this subject before the Boston society for medical observation, Dr. Bowditch reported a case of malaria which he believed to have developed in the Adirondacks. Dr. Folsom had observed that many cases occur in comparatively elevated localities, referring especially to an outbreak in a small town in the western part of Massachusetts, in which all the cases occurred on the top of a hill. It was his experience that persons might live for a time in a well-developed malarial region and remain free from the disease while there, and subsequently have the disease manifest itself after a year's residence in another place.

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THE SUBJECT OF HYPNOTISM, which has become so famous through the recent experiments of Charcot, engaged the attention of Dr. W. A. Hammond of New York some six years ago. At that time he hypnotized a young man in the presence of the members of the New York medico-legal society, causing him while in this condition to commit imaginary thefts and assaults. Dr. Hammond prefers the name 'syggignoscism' to that of 'hypnotism;' meaning the agreement of one mind with another mind, — a condition of automatism in which acts are performed without the conscious willing of the subject. Dr. Hammond finds that persons who are educated and are accustomed to direct others are not so easily rendered hypnotic as those who have always occupied subordinate positions. Mesmerism, so called, is closely allied to hypnotism. The theory of Mesmer was, that there was an inherent quality or power in the person operating, which accounted for the effects produced; whereas the peculiarity is in the subject, and any one can put such a subject into the hypnotized condition.

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THE PROBLEM OF PROTECTING from adulteration the food supply of large cities is one of increasing difficulty and complexity. For its successful solution it depends not only on energetic and intelligent inspectors but on the active support of public opinion. The recent report of Dr. Saunders, public analyst for the city of London, shows that in one case, at least, where the first of the above conditions is conspicuously present the second is conspicuously lacking. The report states that the public at large continues to show marked apathy toward the working of the food inspection laws, and that if the inspectors were not ordered to secure samples independently of complaints being made, no check would exist upon the adulteration of the foods and drugs sold in the city of London. During the year 1886 the department made one

hundred and eighty-eight analyses, of which sixty-one were of milk, twenty-two of whisky, nine of gin, sixteen of mustard, twenty-seven of drugs, ten of disinfectants, six of water, four of butter and butterine, and the remainder of miscellaneous articles. The discrepancies of opinion between analysts resulting from the employment of separate methods, and the unsatisfactory character of some of the laws relating to food supply, are given as reasons which have prevented the work of the department from impressing itself more firmly upon the community. The water supply of the city has maintained its high character during the year, the same freedom from organic impurity noted in previous reports having still existed.

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IN A PRESIDENTIAL ADDRESS — now published as a magazine article — before the Society for the study of comparative psychology, Dr. T. Wesley Mills of McGill university said a great many interesting things about the objects and problems of that department of science which the society was founded to advance. Animals, he said, are the 'poor relations' of man: the latter is one of them not only in body but in mind. But poor relations though they are, yet "in not a few respects they are not only equal, but superior to man." Dr. Mills grants that it is not inconceivable that special faculties, not existent in the lower animals (we presume he uses the adjective 'lower' merely in deference to a custom of some antiquity) have been implanted in man, but the trend of investigation, he asserts, is to establish the fact that at least the germ of every human faculty does exist in some species of animal. Brutes reason, says the writer. They can and do form abstract conceptions. They have, furthermore, a moral nature, and are capable of forming a conception of right and wrong. Man has only developed a superiority to the brute because of "his social tendencies, resulting in the division of labor, with its consequent development of special aptitudes, and its outcome in the enormous amount of force which he can, on occasion, bring to bear against the various tendencies making for his destruction."

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Now, before Dr. Mills puts forward any such conclusions as these, or goes to work with the method and premises he has assumed, he must first establish the legitimacy of that method and those premises. And to do this he must, we fancy, meet the argument of Prof. C. Lloyd Morgan on the subject of the study of animal intelligence. That he has not faced this argument is evidenced by his naïve and apparently conclusive question, "Since from experiments on the brains of the lower animals we argue as to the nature of the brain of man, why may we not pursue the comparative method for the soul?" Perhaps we may; but it must be done under such limitations, and in the light of such considerations, as Professor Morgan has indicated. The first and most fundamental of these is, that, while we are justified in believing in the existence of intelligence or mind in animals, it must be steadily borne in mind that this has to be interpreted not only by human consciousness, but *in terms of it*. Again, in all the stories related of the intelligence, morality, and so forth, of animals, there are two distinct elements, — first, certain actions performed under certain external circumstances, which may be called facts; and, secondly, certain inferences which are drawn from the facts. These inferences must be rigidly excluded from the class of facts; and, when so excluded, that portion of them which is ejective must be treated as such, and not as objective. These limitations and considerations carry with them many consequences, but we can find in Dr. Mill's address no evidence that he has ever given them any consideration.

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THE BEST METHODS for the disposal of garbage must necessarily differ according to circumstances. For some communities its utilization in the feeding of swine is a practical solution of the problem; while for others no better way seems to have been devised than to deposit it at sea, so far from land as to preclude the possibility of its return by wind or tide. Still another plan is that of its destruction by fire or cremation, — a plan which theoretically is perhaps the most satisfactory from a sanitary stand-point, but one in regard to which practically there seem to be so many difficulties as thus far to have prevented its adoption in the largest cities of the United States. This problem is now being discussed at Milwaukee, Wis. One proposition is to take the garbage to the country and then feed it to animals, another is to deposit it in the waters of the lake, and a third to consume it by fire. A company proposes to erect two cremators, at an expense of ten thousand dollars, for this purpose, claiming that the running expenses will not exceed $15.50 per diem

DURING THE PAST WINTER, which was an unusually severe one at sea, the fish commission succeeded in hatching thirty-five million cod-eggs, bringing the young up by hand, so to speak, to the age of self-feeding adolescence, and turning them loose into the ocean. This crop will be 'ripe' four or five years hence. The fish commission will also attempt to repeople our coastal waters with halibut, the supply of this valuable food-fish having been depleted in waters where it was once common. The attempt will probably be first made to plant the halibut in Chesapeake Bay. Advices just received from New Zealand state that a million and a half white-fish ova, sent by Professor Baird from Northville, Mich., last December, to Sir Julius Vogel of New Zealand, arrived there in January in excellent condition, only five hundred having died.

## *CRUELTY OF OLD CUSTOMS.*

WE have several times referred to the case of Rukmibhai, the native lady whose wrongs aroused so general a feeling of sympathy in England and India; but, as the case now appears to be on the point of reaching a crisis, it may be well to recapitulate the facts briefly, as given by the Calcutta correspondent of the London *Times*. Rukmibhai was married, according to Hindoo usage, at the age of eleven, to a youth some years her senior. She remained at her parents' house, was carefully educated, and grew up, according to all accounts, into a refined and highly cultivated lady. Some eighteen months ago she published in the *Times of India*, under the *nom de plume* of 'A Hindoo lady,' a series of forcible and striking letters on the miseries entailed on her sex in India by the barbarous customs of infant-marriage and enforced widowhood. Last year her husband tried to get her to live with him, and, on her refusing, instituted a suit for the restitution of conjugal rights, in the Bombay high court. The case was tried in the first instance by Mr. Justice Pinhey, when, it having been proved that the husband was too poor to support her, was utterly ignorant and uneducated, — in fact, a mere coolie, — and was, moreover, consumptive, the judge expressed the opinion that it would be a barbarous, cruel, and revolting thing to compel her to live with such a man. He further held that such suit could not lie under Hindoo law, and dismissed it.

The husband appealed, and the case was argued before the chief justice and Mr. Justice Bayley. Those learned judges, while expressing their entire sympathy with Rukmibhai, felt compelled to rule that Mr. Justice Pinhey was wrong in law, and remanded the case to the lower court for trial on its merits. It has now been reheard before Mr. Justice Farran. Rukmibhai's counsel could only repeat that his client had never consented to the marriage, and never regarded the man as her husband; that the husband was poor, ignorant, and unhealthy; and that if ordered to return to him she would be forced to disobey, and was prepared to take the consequences. The court had no option save to pass an order that she should join her husband within a month. Should she fail to do so, she would be liable to six months' imprisonment. The case has excited much sympathy among the Anglo-Indian community. The English newspapers are publishing articles and letters on the subject, and steps are being taken in Bombay to raise a fund on her behalf. Among the native community, however, hardly a single voice, except that of Mr. Malabari, a Parsee gentleman, has been raised in her favor, and the so-called reformers who agitate loudly for representative institutions, etc., say no word for the alteration of the cruel law which the Bombay court has been reluctantly compelled to enforce.

Upon this case the *Times* comments as follows: "There can be no doubt to which side opinion in this country will incline. Our correspondent tells us a tale of monstrous wrong and of injustice in the disguise of law. But the disguise, unfortunately, is impenetrable. The law is the law, and in the view of Rukmibhai's fellow-countrymen there is nothing shocking or revolting in the end which it has been employed to serve. The Hindoo marriage-law can claim, with justice, to have the sanction of immemorial usage. Whether it is based or not on a correct interpretation of the sacred books, — and there is room for grave doubt on this point, — it has prevailed for some thirty centuries, and it is closely interwoven with the moral and religious sentiments of the people. Religion pronounces that every Hindoo girl must be married. The parent who has an unmarried daughter of full age in his house is not only an offender against social usage, but is guilty of a religious crime, threatened with puishment in a future state, and one which his outraged neighbors will not be satisfied to leave to its deferred theological sanction. The father would be a degraded man. His daughter, therefore, must be married to some one, and if no fit person is forthcoming, she must be joined to some unfit person, and this at the earliest age possible, so as to settle the matter and make things safe for the father. Rukmibhai has been treated with somewhat exceptional favor in having had her marriage ceremony put off until she was eleven years of age. Many

Hindoo girls are married much earlier, in their seventh or eighth year, and once married, there is no escape possible for them. Wifedom may be a revolting servitude, but widowhood is a living death. The widow is an outcast, with no civil rights and no social standing. Her proper place would have been on her husband's funeral pile, but since suttee has been forbidden, a fate more cruel, an agony more prolonged, has been the appointed lot of the woman who survives her lord. Now, whatever we may think of this system, it is quite certain that it commends itself to Hindoo feeling. So strong is the sentiment in favor of it that Lord Dufferin has not ventured to attempt a change in the law. He has sounded native opinion on the subject; he has consulted the local administrations, and the replies he has received have been unanimous against any legislative interference. Rukmibhai is, therefore, a wife in the eye of the law, and a wife she must remain.

"The present feeling of the Hindoo community in favor of the existing marriage-law has been signified in a variety of ways. When there was talk of the possibility that the government might interfere to change the law, a large meeting was held at Bombay to protest against such a course. It was not unanimous, but the voice of the majority was given, not only against a compulsory change in the law, but in support of the law, which they cherished as being of social and religious importance. The daily conduct of the people is in agreement with this declaration. They inflict the social penalties which are the main sanction of the law, and without which the law would speedily fall into disuse. But as long as there is a minority of dissentients, social penalties are not very dreadful to those who can dare to face them. The meeting at Bombay shows us only what the men think, and it shows us that even they are not entirely of one mind. It tells us nothing about the women. We know from Rukmibhai's case that there is one woman, at least, who has cut herself free from the superstitions and prejudices of her country. As education spreads, and as the medical missions to women begin to bear the full fruit which we may expect from them, the number of the emancipated will grow. Hindoo women will learn the rights of their sex elsewhere, and will demand a share in them for themselves. It is the women who suffer under the present Hindoo marriage-law, and it is from one of their number that the first act of open rebellion has come. We trust that the example will be of service towards a general enfranchisement of the sex. When the day comes at which the women refuse to be bound by the tyrannical rule imposed upon them, the men may resolve as they will, but they will be forced to yield nevertheless; and we are quite sure that the sacred books will be found quite elastic enough to justify both parties, the rebels and the consenters to the rebellion. The process of change may be slow. The customs of thirty centuries are not to be uprooted at a stroke. It will be enough if there is some progress made. If Rukmibhai finds even a few who will support her in her stand, she will have dealt no light blow at the law which has driven her to revolt."

## *PARIS LETTER.*

THE sugar-beet industry in northern Germany is in great apprehension, owing to the destructive effects of a newly described parasite, a nematoid worm, which, according to M. A. Girard's recent paper read before the Academy of sciences, is doing great damage in the beet-fields. This worm is found at the end of the roots, in the so-called 'suckers' of the smaller radicules, and uses for its own benefit all the alimentary matters absorbed by the roots. The consequence is, that the plant soon withers and dies. But not so the animal. It is ploughed out of ground to be swallowed by any chance animal. It is finally expelled, in good order, perhaps in a beet-field, where it immediately begins again its depredations. No method is yet known for the destruction of this parasite. It is, however, of some value to know how it lives.

An interesting paper on therapeutics has been published by M. Jacobelli, who is trying to cure pulmonary tuberculosis by means of inhalation of caustic vapors, believing they will cause the ulcers on the lungs to heal. No good results have yet been detected, and it does not seem likely that any will be obtained. Unless the vapors kill the bacillus, there does not seem to be any possibility of a useful influence. Tuberculosis is the result of the presence of the bacillus; and so long as this microbe remains in the body, tubercular symptoms must be present. As the old saying goes, '*Sublata causa, tollitur effectus*,' and in this case it is not the cause, but a symptom only, that, very uselessly it seems, is being combated.

The French government has recently obtained from Greece permission to prosecute archeological investigations in what remains of Delphi. This city was, except Olympia, the most important sanctuary of ancient Greece, and it contained an abundance of art-specimens, which made it quite a magnificent gallery. It is generally believed that the remains of the temple of Delphi, at present covered by a small fort, contain many specimens of great interest for archeology and art. The American government petitioned for

the same privilege, but was forestalled by the French delegates, owing to the perseverance of MM. de Mouy and de Montholon. Whether French or American workers do the work, matters little: the essential thing is, that it be well done and profitable to archeology.

A recent paper read at a meeting of the Biological society spoke at length of the possibility of obtaining glass or crystal lenses thick enough to resist a pressure of a thousand atmospheres. In order to study *de visu* the influence exerted on animals by high pressures, it was desired to fix in an iron or steel apparatus a lens allowing a constant supervision of what was going on inside. Quartz was first used, but it could not withstand more than four or five hundred atmospheres. Then glass was used, and also a different manner of securing it. The results were very good. By means of the leather half-cylinder used in hydraulic presses, the glass lens was very well held and made fast, and the lens itself (fifteen millimetres thick and forty in diameter) supported a pressure of a thousand atmospheres without the slightest inconvenience.

The first two numbers of the *Annales de l'institut Pasteur* have been published, under Professor Duclaux's direction. They contain much good material. In the first number there is an interesting letter from Pasteur, concerning antirabic inoculations in general. The second number contains a paper by M. Roux on culture-methods for antirabic microbes, which will be of use to many. Dr. Gamaleïa has contributed a long and very interesting paper on paralytic rabies, showing that this form of the disease, considered uncommon, and believed by M. Peter to result only from experimental rabies, is in fact common, and has been frequently met with by himself and others.

The vine-growers of Algeria are now seriously troubled by the destruction caused in their vineyards by an insect, Altica ampelophaga, which threatens to become a curse, very troublesome, but less dangerous than phylloxera has been to continental vineyards. This insect is becoming very numerous, and its effects are considerable already. In some places more than a third part of the whole production is destroyed by it. It feeds on grape-vine leaves only, eating them as fast as they appear, and ultimately killing the vine. As it is a very prolific insect, giving over five generations in a single summer, much is to be feared from it. During the winter it hides in recesses under the bark of trees, under dead leaves, in the earth, etc. Many methods have been tested to destroy it, but those that are good cost too much. This plague has been long known in Spain. In mediaeval times public prayers were ordered in Andalusia when the insects became too numerous. It is unnecessary to say that no results whatever were noticed, and even Catholic Spain now deems it better policy to try and fight the plague without asking for supernatural aid.

At a recent meeting of the Biological society, M. Ch. Ozanam presented a paper on the use of carbonic acid as an anaesthetic. The carbonic acid, mixed with air, is inhaled. The anaesthesia so induced is a very complete one, without danger, and may last a long time. M. Ozanam has used this method in operations on man, and is quite satisfied with the result. These facts have been confirmed by M. Grihant. It must be noticed that the anaesthetic properties of carbonic acid have long been known. Carbonic acid was most likely the first anaesthetic used, as it has been surmised that the anaesthesia induced by the physicians of ancient Egypt and Greece was due to the carbonic acid evolved by the contact of vinegar and marble.

M. E. Bérillon has recently published an excellent little book giving an accurate account of Paul Bert's work in physiology. It is equally readable for scientists and the general public. The principal results of M. Bert's work in the various branches of physiology are analyzed and explained in a very clear and correct manner, and a list of his principal contributions is appended.

A new medical paper has just been started by Professor Grancher of the Paris medical school. It is the *Bulletin medical*, and is expected to prove a success. Medical papers are generally of little value in France, save, of course, those which contain only original matter. The papers intended to keep practitioners well posted upon the progress of medical science are very incomplete. None can compare with the *Lancet* or *British medical journal*, or with the best American papers. Many of them are worth nothing, and it is a wonder they contrive to live. The *Bulletin medical* has correspondents abroad in great number, and contains a great deal of matter in the shape of original contributions, chemical lectures, reviews of books and scientific papers, society transactions, etc. It is published twice a week. V.

Paris, March 9.

## GEOGRAPHICAL NOTES.

### Asia.

The Russians and the English are equally earnestly engaged in exploring central Asia. Mr. A. D. Carey of the Bombay civil service is now making a journey of considerable interest. *Nature* says, "Mr. Carey left India in May, 1885, and

marched through Ladak into northern Tibet (Chángtán) as far as the Mangtsa Lake, and then struck northward, descending on the plain of Turkestan, near Kiria. He thus traversed over three hundred miles of country which had never before been visited by a European. The altitudes on this section of the journey were always very great, the track running usually at about sixteen thousand feet above the sea, while one, at least, of the passes crossed, was calculated to reach nineteen thousand feet. After a stay at Kiria and Khotan, the Khotan River was followed to its junction with the Tarim; the route then lay along the latter river to Sarik, and then across a stretch of desert to Sháh-Yarand Kuchár. From the latter place the Tarim was followed down to a point where it turns southward towards Lake Lob. From this point the towns of Kurla and Kárástaber were visited, and about the end of the year the Tarim was struck again and tracked down to Lob-Nor. Thus the whole length of the Tarim has been explored. The country along its banks is described as flat and reedy, and the people extremely poor and miserable. Mr. Carey pitched his camp at the village of Cháklik, some distance south of the lake, and close to the foot of the great range of mountains which forms the northern scarp of the Tibetan highlands. On April 30, 1886, Mr. Carey started from this village on a journey southward into Tibet, over a pass in the Altyn Tagh range, and onward by a track occasionally used by the Kalmucks. Since this start, nothing has been heard of Mr. Carey, but it is presumed, that, after spending the summer and autumn in travelling over the elevated region, he has returned to Turkestan to winter."

*Africa.*

Stanley's expedition arrived at the mouth of the Kongo on March 18. According to *Nature*, Stanley, on his arrival at Stanley Falls with the first contingent of his expedition, about 250 men, will proceed at once to Emin Pasha, without waiting for the rest of his party. No doubt he will be re-enforced by some of Tippo's men. The main body will follow as soon as the steamers are able to land them all at Stanley Falls, but first a camp will be established, at some distance from the Falls, as a base of operations.

The reports published by the Kongo association on the state of affairs on the upper Kongo are a strong contrast with letters published by the Paris geographical society. Some details on the loss of the Stanley Falls station are given, and the fear is expressed that the Arabs might attack the Bangalla station. Besides, the intercourse on both shores of Stanley Pool is said to be interrupted by the natives attacking the caravans. It is probable that Stanley's negotations with Tippo-Tip may lead to the establishment of friendly relations between the Arabs and the Kongo Free State. The latest news says that Tippo-Tip is to be appointed chief of the Stanley Falls station.

Lieutenant Baert, who explored the Mongalla, states that at the farthest point reached by him it is only thirty feet wide and four or five feet deep. This place is very near Junker's Ali-Kobo, on the Welle. Baert's statement shows plainly that the Mongalla is not the lower course of any one of the rivers the sources of which were explored by Junker, but that its drainage area is a small one.

Dr. Zintgraff, who visited West Africa a few years ago, has been commissioned by the German government to explore the river system of the Cameroon districts in the little steamer Nachtigal. He intends to visit the Cameroon Mountains. As large quantities of caoutchouc are said to be obtained there, he will be accompanied by an expert in that material.

*America.*

It must be regretted that congress failed to appropriate the money demanded for a survey of the boundaries between Alaska and the British possessions, and between the south-western territories and Mexico. Besides its being desirable from a scientific point of view, it is practically of great importance. The discovery of rich gold-deposits near the boundary between British Columbia and Alaska may furnish grounds for another quarrel between the United States and Canada. The boundary, as defined by the treaty with Russia, follows the summit of the mountains situated parallel to the coast as far as longitude 141° west, and is in no place more than thirty nautical miles from the coast-line. Of course, this definition is very vague, and disputes between American and Canadian miners may be expected if the survey is not soon undertaken.

*Polar regions.*

Mr. A. McArthur's prospects of being successful in his enterprise of reaching the north pole are not very promising. He left Winnipeg only a few weeks ago on the way to Hudson Bay. A few days ago his companion returned to Winnipeg, having left him to go on alone. Nevertheless, McArthur may do good scientific work in Hudson Bay, if he resolves to confine himself to researches in that region.

According to the *Dagblad* of Copenhagen, the population of northern Greenland, about the end of 1885, was 4,414 (2,119 males and 2,295 females);

that of southern Greenland, 5,500 (2,557 males and 2,943 females). The increase of population in 1885 was 86 in the northern and 31 in the southern part. The slow but steady increase forms a favorable contrast to the rapid decrease in the English and American parts of arctic America. The Danish government takes care of the natives, who fully repay the outlay of the government by the produce of their hunting and fisheries. The English and Americans, though they claim the country, leave them to the mercy of whalers and traders, whose disastrous influence will destroy them within a short time.

The whalers who annually visit Baffin Bay state that the enormous mass of land-ice which, in 1884, extended from the shore of Baffin Land to a distance of about sixty miles, did not give way until the summer of 1886. The ships were unable to approach the coast from Cape Bowen to Cape Searle for three years. After the ice had broken up, whales were found in great numbers in Cumberland Sound and near Cape Mercy, while in the previous years hardly any were met with on these grounds.

## *NOTES AND NEWS.*

THE U. S. coast survey lost one of its most capable assistants recently by the death of Mr. Carlisle Terry, jun., who died at his home in Columbus, Ga. Mr. Terry was a young man of great promise, and his work on the Pacific coast during the past winter had been most successful, being highly commended by the authorities at Washington.

— A halibut weighing thirty-four pounds and measuring forty-one inches in length was captured recently in the lower Potomac, near Colonial Beach. This is the first authentic case of a halibut in fresh water. Hitherto it was supposed that the vicinity of Long Island was the extreme southern limit of the habitat of this fish. The specimen caught in the Potomac has been preserved in alcohol by the Smithsonian institution, and a cast has been made and placed on exhibition in the national museum.

— Three fine specimens of carp have been caught in a net in the lower Potomac, one weighing over seven pounds. The fish commission have preserved these fish in their large aquaria at Washington. Several white-fish and bass were also taken in the same locality. These are evidences of the good results attained by the U. S. fish commission in the propagation of food-fishes.

— The gem-collection in the national museum has just been enriched by the addition of the pearls and diamonds given to President Van Buren by the Imaum of Muscat. These valuable jewels have been lying in the vaults of the treasury for nearly forty years, and were previously on exhibition in the patent office; but some of them were abstracted, and they were placed in the treasury vaults. There are one hundred and fifty pearls and one hundred and six diamonds, the latter aggregating twenty-one carats in weight.

— Prof. C. V. Riley, the entomologist of the agricultural department, has gone to California to investigate various matters which have been demanding the attention of his bureau for some time. His special mission is to investigate the Coltony cushion scale, an insect imported from Australia, which is doing immense damage to the citrus-orchards of California.

— The new naval observatory, for which congress appropriated $400,000 several years ago, is to be built in the near future. Mr. Richard M. Hunt of New York has been appointed architect of the building. Contracts for the work on the observatory will be made, and the building operations will shortly begin.

— The second spring meeting of the Indiana academy of sciences will be held on May 19 and 20, 1887, at the 'Shades of Death,' near Waveland, Montgomery county, Ind. This place is situated on the banks of Sugar Creek, which here passes through a deep gorge cut in the subcarboniferous sandstone.

— The Marine laboratory of the Johns Hopkins university has been opened at Nassau, New Providence, West Indies, under the direction of Dr. W. K. Brooks.

— The Harvard natural history society, having for a number of years been in a particularly dormant state, has recently, by the energetic work of its president, Mr. Nolan, sprung into life again. Under its auspices there will be a series of weekly lectures, or rather talks, at the society's rooms, upon the local fauna and flora. The first of the course is announced for March 30, to be delivered by Mr. Samuel Garman, upon the reptiles of Massachusetts. Other talks will follow, on the Wednesday evening of each week, by Mr. S. H. Scudder on butterflies, Dr. J. S. Kingsley on crustacea, Mr. James Emerton on Spiders, Mr. William Brewster on birds, and others not yet announced.

— Mr. William H. Dall of the Smithsonian institution has just returned from a trip to Florida, embracing a trip up the Caloosahachee River, where he went in search of fossils. His trip was most successful. This deposit was first discovered

two years ago, and the first visit to the fossil region was made last year by Professor Heilprin and Mr. Wilcox of Philadelphia. About half of this immense deposit is of an almost extinct class, and the remainder is of similar material to that found farther south, notably in the West Indies. Mr. Dall considers this fossil deposit the finest yet found in the United States. On Little Saratoga Bay a rock was found in which there were fragments of Indian pottery of rude workmanship, showing that the occupation of Florida dates back into the earlier ages.

— The U. S. coast survey is about to begin operations in the field, after a suspension of six months. The following work has thus far been mapped out by the superintendent. The geodetic levelling party, consisting of Assistants J. B. Weir, J. E. McGrath, and W. B. Fairfield, have suspended work in Mississippi and Alabama, the appropriation for its continuance being exhausted, and have returned to Washington. This party will take the field again in New York, and will run a line of precise spirit levels around the main harbor of New York, connecting all the bench-marks and tidal stations with this line of levels, and with the New York end of the transcontinental line. This line will also be connected with the line of levels which extends up the Hudson River from New York to Albany. A detailed hydrographic survey of a portion of Baltimore harbor will be commenced on the 1st of April by Assistants W. J. Vinal and E. L. Taney, under the immediate supervision of the engineer, N. H. Hutton, of the Baltimore harbor board. All the parties on the Pacific coast have received instructions to take the field, the appropriations being in such condition that the work will probably be carried on continuously from May 1 to Dec. 1. The telegraphic longitude parties in charge of Assistants Edwin Smith and C. H. Sinclair are instructed to take the field between April 1 and 20. Their first work will be the connection of Davidson's observatory, San Francisco, with Salt Lake City. This promises an important link in the longitude determinations of the Transit of Venus station near Fort Selden in New Mexico. The topographical and triangulation parties will take the field on the coast of Maine about the first of May, or earlier if the season permits. Three or four topographical parties on the north side of Long Island Sound are expected to fill in the few gaps in the topography that now exist between the shore-line and the New York, New Haven, and Hartford railroad. Assistant J. F. Pratt and Sub-assistant Fremont Morse have been instructed to make a preliminary topographical reconnaissance of Washington Territory on the Pacific coast. A survey of this uninhabited, unapproachable, and almost unknown portion of the Pacific coast is greatly needed.

— There are sixty candidates for the fellowship of the Royal society this year, about the average number for the last four or five years. The council will in April select fifteen of these for recommendation to the society, and the election will take place on the 9th of June.

— The next session of the National academy of sciences will be held in Washington, D.C., beginning Tuesday, April 19, 1887, at 11 A.M.

— Dr. R. N. Cust, well known for his valuable linguistic and ethnological treatises, and particularly for his works on the 'Modern languages of the East Indies' and the 'Modern languages of Africa,' is preparing a similar work on the 'Modern languages of Oceania.'

— A reproduction of part of the map in the first bulletin issued by the New England meteorological society was given in *Science* for Jan. 2, 1885. Thirty-six observers then contributed to the society's records. The number is now a hundred and fifty.

— For five years the Brookville, Ind., society of natural history have given a course of free popular lectures. The course this year has thus far been the most popular of the series. The following lectures have been given this winter: Oct. 15, 'The study of man,' by D. G. Brinton; Nov. 26, 'The intelligence of instinct,' by J. P. D. John; Dec. 17, 'World-building,' by George M. Maxwell; Jan. 14, 'The study of mythology,' by L. H. Thomas; Feb. 4, 'Three weeks without water,' by H. W. Wiley. The following lectures are yet to be given: March 11, 'Life among the Japanese,' by T. C. Mendenhall; April 1, 'Our national park,' by J. M. Coulter; April 29, 'Agassiz,' by D. S. Jordan.

— Dr. Peale has brought together in his paper on the mineral springs of the United States, (Bull. U. S. geol. surv., No. 32, Washington) an immense amount of information about the mineral springs of this country. The list was formed primarily to aid in the statement of the commercial value of mineral waters as part of the mineral resources of the United States; but it will have a much wider usefulness than that would imply. It is small praise to say that this list is the most comprehensive that has yet been issued. The most complete before this, that of the American medical association, mentions about five hundred localities; while Dr. Peale has collected data as to 2,822 localities, including more than 8,000 springs. Even this is necessarily an imperfect enumeration, and must be regarded as 'preliminary to more de-

tailed work.' In addition, the list contains analyses of more than 800 springs, and, wherever possible, the temperature, volume, and character of each spring are given. Only those who have done similar work can appreciate the amount of thankless drudgery involved in this useful paper.

## LETTERS TO THE EDITOR.

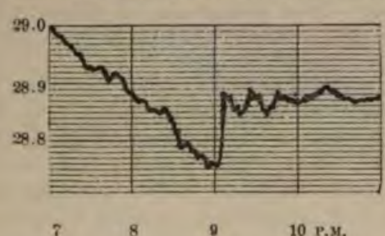
****The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Barometer exposure.

ABOUT noon of Feb. 18 the barometer at Blue Hill observatory began to fall rapidly, and continued to do so until about 9 P.M. During this fall the wind steadily increased in velocity, and between 8 and 9 P.M. was blowing almost a hurricane. Immediately after 9 P.M. the hurricane-like roar of the wind suddenly ceased. Glancing up at the observatory barograph, I saw that it was rapidly rising, and within two or three minutes had risen more than a tenth of an inch. The barograph is of the Draper pattern, and multiplies three times. The accompanying diagram is a copy of the part of the barograph trace on Feb. 18, showing the rapid rise in pressure referred




to. There was thunder and lightning for about an hour preceding and following this sudden rise.

The following are the wind-velocities in miles per hour for each five minutes as obtained from a Hahl anemograph: —

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time (P.M.)................ | 8.30 | 8.35 | 8.40 | 8.45 | 8.50 | 8.55 | 9.00 | 9.05 | 9.10 | 9.15 | 9.20 | 9.25 | 9.30 | 9.35 | 9.40 | 9.45 | 9.50 |
| Velocities (miles)........ | 65 | 60 | 64 | 69 | 71 | 69 | 65 | 31 | 36 | 48 | 35 | 15 | 18 | 30 | 37 | 36 | 33 |

After 9.50 the velocity varied but little for several hours. It is seen that between 9 and 9.05 P.M. there was a sudden decrease in the wind-velocity of about 35 miles, coinciding with the sudden rise in pressure; and, furthermore, each of the less-marked fluctuations of the barograph curve following this is connected inversely with corresponding variations in the wind's velocity.

The change in wind-velocity was evidently connected with the rise of the barograph at 9 P.M.; and the question presents itself, Was the rise of the barograph evidence of an actual existing difference of pressure in the atmosphere, or was it a merely mechanical effect of the wind sucking the air out of buildings while the wind-velocity was high, and allowing it to flow in again as the wind-velocity decreased?

From what we know of the connection of wind-velocities with barometric gradients, it would be anticipated that such a difference of pressure in the atmosphere as would cause a rise of the barometer at any point to the extent of a tenth of an inch in a minute or two, would give rise to an enormous increase in wind-velocity. But, instead of finding the increased wind-velocity with the rise of pressure, there was just the opposite: hence the inference is, that the rise of the barograph was due to the decreased wind-velocity relieving the stress on the air in the building.

On examining the barograph trace obtained by Professor Davis at the Harvard laboratory, ten miles north of Blue Hill, it is found that an almost identical and equal jump of the barograph curve occurred within a few minutes of the rise at Blue Hill; so that, whatever the origin of the rise, it was evidently due to some general cause acting similarly over a comparatively large area.

The observations of the signal service taken all over the United States at 10 P.M. show that there existed at that time a large cyclonic storm central north of Lake Superior. The circulation of the wind, as well as the bending of the isobars, also give undoubted evidence of the existence, at the same time, of a small secondary over New England.

An explanation of the sudden decrease of wind-velocity hence suggests itself. Previous to 9 P.M. the vicinity of Boston was on the outer edge of the secondary, where the isobars were greatly crowded and the wind-velocity high; but at 9 P.M. it suddenly entered the progressing central area of the secondary, where the pressure was more uniform, and the wind-velocity immediately decreased. This explanation necessarily involves the assumption that the pressure in the vicinity of Boston was lower after 9 P.M. than preceding it, and the apparent rise was merely a subjective effect due to the wind. No other assumption seems to me reasonable, especially when we find at 10 P.M. the wind over a small area circulating around and centring in toward southern New England.

H. HELM CLAYTON.

Blue Hill meteor. observ., March 25.

### On certain electrical phenomena.

I hasten to acknowledge that I unintentionally misrepresented Dr. Shufeldt in one sentence of my letter in *Science*, No. 213. I was wrong in affirming that he stated that he had never observed such exhibitions in Washington; for what he really said was, that he had never observed them as far as his own person was concerned.

I hope Dr. Shufeldt will be equally ready to admit that he has misrepresented me in his reply to my remarks (*Science*, No. 216), where he has omitted the essential part of one of my sentences, and altered the remaining part, even going so far as to include the 'mangled remains' in quotation-marks. Any one who will take the trouble to examine my first letter will see that what I really advised him to do was to *critically examine* his facts, "possibly eliminating a

few of them," etc. Everybody will understand the meaning of the sentence, which was, that a close examination of what he had assumed to be facts might lead to the rejection of a part thereof.

But it is also perfectly plain that all of this has really no bearing on the point at issue. It is always easy to quibble about words and phrases, while it is not always easy to avoid error in observation or erroneous deductions from correct observations.

If Dr. Shufeldt's observations and conclusions are correct, they are of the highest importance, and they must be subjected to the most searching examination before acceptance. I must still confess that there is much that is mysterious to me in his account of his sensations and observations. I do not understand what he means by saying, "My entire system seems to become thoroughly charged with this animal electricity." His "sense of the most profound relief," etc., in the case of the mulatto girl, is a mystery to me. His inability to use any other than a rubber penholder, and the statement that "even then the constant passage of the electricity is exceedingly exhausting during most of the time," are hard nuts for me to crack. In short, the whole matter hinges upon the question with which my first letter closed, — "Is man one of the extremely small number of animals having specialized electrical organs?" for only in that case is the expression 'animal electricity' properly applicable. In that letter I gave reasons for the belief that all such phenomena, the existence of which was certainly established, were nothing more than cases of accidental electrification by well-known methods and under long-recognized conditions; that under similar conditions no differences among individuals could exist; that such electrifications had been known for a long time, and that no extension of well-established principles was needed for their explanation.

To this statement nothing need be added until Dr. Shufeldt, or some one else, shows that it is insufficient to account for observed facts.

T. C. M.

Terre Haute, March 27.

## A sensitive wind-vane.

In the last number of *Science*, under 'A sensitive wind-vane,' the statement 'The notation is the same as,' etc., should be 'The notation is opposite that,' etc.

H. ALLEN.

Washington, D.C., March 25.

As suggested by Mr. Allen in his interesting letter in *Science*, No. 216, it is important first to determine what is meant by a sensitive vane, and still more important, in my judgment, to determine what kind of a vane is wanted in meteorological observations. I have experimented a good deal with both the long, heavy vanes, and those which are short and light. Neither variety, as ordinarily constructed, is satisfactory. I have more than once seen two large 'standard' vanes, on the roof of the office of the chief signal officer in Washington, sullenly staring each other in the face, while a very light breeze held a short and very light vane nearly at right angles to both of them. Such performances are confusing, to say the least. But it seems to me not impossible to have one vane which shall satisfy all the requirements. The desired conditions are to be met with in what is known as the *dead beat* galvanometer. In this, the needle under the action of a steady current, whether strong or feeble, moves to its proper position, does not go beyond it, and does not vibrate about it. This is brought about by making use of a force opposing the movement of the needle, which increases with the angular velocity of the needle, and is zero when the needle is at rest. Something of the same kind ought to be accomplished, and I think may be, for the wind-vane. The force opposing the motion of the vane should increase with its velocity, and *should be zero when the vane is at rest*. If the latter condition is strictly satisfied, it will be infinitely sensitive: the slightest breeze will move it, but the opposing force will prevent violent oscillations. Such a vane will be somewhat slow in its movements, and may not respond to extremely rapid fluctuations in the direction of the wind, through only a few degrees; but I do not believe meteorologists will consider this a serious objection. What is wanted is a vane which will be steady in a high and somewhat varying wind, and which can be controlled by the slightest movement of the atmosphere. About two years ago I suggested what appeared to me to be a solution of the problem. It was to use a small and extremely light vane, so as to reduce ordinary friction to the lowest limit, and then to 'deaden' its motion by means of a liquid damper. This might be applied at the extremity of the axis of the vane produced below the roof, or at any points in that axis. A fan attached to the axis, and moving in a closely fitting vessel of oil or other suitable liquid, would afford almost any desired degree of stability.

Some steps were taken towards the construction of such a regulator, but I do not think it has ever been completed. Possibly the same method may have been experimented upon by others.

T. C. M.

Terre Haute, March 27.

## A question for economists in regard to value.

Will not economists undertake to make some agreement as to what the meaning of the word 'value' is to be in scientific discussions? That a uniform meaning be given to this word is most essential to an intelligent discussion of an economic subject.

As an instance of the necessity of such an understanding, see the last number of *Science* ('Professor Marshall on the unit of value'). In that the professor evidently assumes that the market-price of commodities is their 'value.' Yet we all know that the price of a thing may be greater or less than its 'value' or worth. In order to establish a 'unit of value,' the professor proposes a plan whereby the variations of prices of commodities shall be averaged, and that plan implies that a dollar (money-unit) shall be established whose weight shall be increased or decreased from time to time as the average commodity price increases or decreases. All this is a matter of *money* and *price*, and not *value*. The real thing to be determined is what is *value*, and then a measure may be designed for it.

At present there is among economic writers a great confusion in the use of the word 'value.' Some, as Professor Marshall, use it as meaning price (market-price); some, comparative utility; some, exchange value; some, cost of production in terms of human labor; and some, "the average amount of socially requisite labor measured by time" involved in the production of the article. I hold that this last is the

best definition of value or worth, and that it should be adopted as the scientific meaning of the term.

At any rate, a discussion on this topic is most timely. The basic idea of the modern labor movement is the idea that workingmen do not get an *equivalent* (equal value) for what they produce. If scientific men are to take any hand in practical politics or applied sociology, this is the point where their work is most required at present.

E. LANGERFELD.

New York, March 26.

## The destructive caterpillars of the squares of New York.

Since the importation into America of the quarrelsome, active, and noisy English sparrows, which have driven the quiet and brilliant birds of the south from the city gardens and parks, a new prolific horde, with fierce appetites, every year more extended, threatens to destroy our fresh and green shade-trees.

As early as 1882 the *New York evening telegram* sounded a note of alarm on this subject, to which we added another, but without effect. When nature threw off its summer mantle, and this ravaging army quietly took up its winter quarters, every thing seemed to be forgotten, and our modest communication no doubt went into the pigeon-hole of oblivion; nevertheless, we try again.

After three years' study of the devastating habits of caterpillars, we tried to engage the attention of the committees having charge of the city parks; but to no purpose, for in the summer of 1883 the enemy had greatly multiplied. After some years of neglect, it was too late to save from destruction the plants which had become insufficient to feed the successive broods of myriads of caterpillars. The new-comers soon got beyond the city limits; and once getting a foothold in the suburbs, science, the fruit of observation, could no longer keep within bounds the voracity of these unattackable hairy pests.

The damage of one year may be unlike that of the preceding or following; atmospheric changes may destroy multitudes; but the enemy is prolific, and will in a year increase ten, a hundred fold, and even more.

As the press of New York and even intelligent citizens may think that this enemy has disappeared, we raise a new cry of alarm, addressing ourselves to the learned societies of our adopted country, at the same time communicating the results of our studies to intelligent readers interested in the natural sciences. Our statements will be based on facts observed by us in New York, supported by the testimony of learned colleagues with whom we (myself and son) have corresponded for more than two years, during which we have studied the increasing ravages of this coquette with brilliant, silky, and variegated dress which science names the Orgyia caterpillar.

When the European sparrow was first introduced into the parks of New York, a caterpillar was there committing great depredations. Linnaeus called it the geometer: we call it looper, spanner, and canker-worm. The larva has six feet on the first three segments, and four on the last two, and as it progresses seems to measure the ground. The sparrows were very fond of this caterpillar, to a degree that their increasing numbers speedily exterminated it: for this they deserve our gratitude. It was different with the larvae of the Orgyia. Consequently we have thought it might be of interest to the public to say a little of what is known of the habits of the first as compared with the second equally destructive species. The first still exists in many private gardens in New York

*Phalaenidae.* — The butterflies which come from the larvae of the geometers almost all have the body slender, the thorax narrow, and wings proportionally wide; their flight being consequently more uneven and jerky, more unsteady, than that of the nocturnal species: the flight, in fact, is more like that of the diurnal ones, but is neither so strong nor of long duration, on account of the comparative weakness of the framework of the wings. They especially like serene and still evenings and nights. But there are to this characterization many exceptions. Some of the Phalaenian larvae have 12 legs, and some even 14; among the nocturnal species, again, some have 12 and others 14 legs; the general rule being 16 legs among the nocturnal, and 10 among Phalaenians. It is also a curious fact that the larvae of those with 16 legs loop in progressing, for some reason making no use of the intermediate legs.

Another kind of exception is that some Phalaenians which are nocturnal, a small number it is true, have a diurnal flight; that is to say, that certain species fly in full sunlight, gathering food on flowers in company with diurnal butterflies: so that the division into diurnal and nocturnal species is, in this respect, conventional. It is, however, true that day butterflies have almost always the antennae club-shaped, and come from larvae with 16 legs; while the Phalaenians, whose larvae have 10, 12, or 14 legs, have filiform or pectinated antennae.

There are in Europe some 600 Phalaenians, 700 nocturnal, and 400 diurnal butterflies; though it is probable that in hot climates the diurnal are more numerous than in the temperate. The Phalaenians, especially in cold regions, have usually sombre colors, gray or black, though there are many exceptions. In France there is a large and handsome green species, which is a common symbol on the tombs of children, probably on account of its delicate form and color. They hatch at all seasons of the year: there is even a group (Hyberniadae) which appears in December, January, and February. The Phalaenians may emerge from the pupa even below 50° F., while the others, and especially the diurnal species, require at least this temperature.

In Hibernia we find a singular fact. The females have either no wings, or semi-wings unfit for flight. As the pupa is generally in the earth, the female, on emerging, crawls up the nearest tree, where pairing takes place; the male bearing her to the top of the tree, and sometimes carrying her off in his flight. The females are small; and the males, much larger, deposit them in places proper for the support of the larvae, — buds of flowers, or masses of leaves, according to the species. There are in this group some veritable pests for man. The H. de foliaerio sometimes so destroys the leaves of forest-trees, that, unable to respire, they either die or partially wither. The H. brumata consumes every thing in the orchards, attacking the flowers of all kinds of fruit-trees.

It would be interesting, but impossible here, to speak of the habits of many of these butterflies, and to note their exceptional characters; but a single example must suffice. There is among the Phalae-

nians a group of about one hundred species, all with different habits, — the Eupithecia, studied for many years by M. Goossens of Paris, from whom these details are taken. The E. rectangularia, so named from the design of the upper wings, emerges from the pupa at Paris in April. After pairing, the female deposits an egg in the midst of the flower of an apple, pear, or quince tree. The egg, which is yellow, is well hidden in the heart of the flower, and is hatched in a few days. The larva, hardly visible to the naked eye, is of a rosy-white color, and begins its work by attaching one end of a thread to the top of a petal, and the other to the heart of the flower; by its traction the petal being bent down. The same is done with the five petals; and the larva is thus enclosed, protected from wind, rain, and parasites. It can with impunity devour the base of the flower and of the petals. The pollen of the male flower cannot fecundate the female flower, which is the one selected by the larva, and consequently there is no reproduction and no fruit. As the eggs have been widely scattered by the female's instinct, a few of these insects may render abortive the flowers of an orchard, or even of a region, without any reasonable explanation for the horticulturist. So many similar insects attack in this or other ways our fruit-trees, that in some places it is an astonishing event to see an apple on a tree.

While remembering that the European sparrows have done great service to New York by destroying the larvae of the geometers, or canker-worms, almost all of which are bare and smooth, it must be said that they are useless, and even injurious, in presence of the larvae of Orgyia. Sparrows, like most birds of the genus, do not like the hairy larvae, from the irritation they cause in the throat and stomach. One may frequently see poultry seize such larvae, kill them by beating them on the ground, and then leave them without eating them.

*Bombycidae.* — In this family belongs the larva which of late years has been so destructive in the parks and gardens of New York. For a long time we sought to discover its place of origin, how it arrived here, became acclimated, and multiplied to such an astonishing degree without meeting the parasite which destroys it. At first we thought it had been imported from France, where a species of the group, Orgyia antiqua, had been known in the Paris squares for several years, devouring trees and shrubs, and sometimes a pest among the rose-bushes. After having carefully compared it, with the aid of M. Goossens of Paris, it seemed to come very near to, if not to be, the O. vetusta, — a species common in California, which places its cocoons in the interstices of the bark of trees, the grooves of lamp-posts, cracks in wooden fences, and also between the hoops on wine-casks on the wharves. In the last way, the insect, which does not bear transportation well, might be carried even across the continent or the ocean. Without the necessity of this derivation, it has now been ascertained that the species is O. leucostigma Smith, which occurs in the neighborhood of Davenport, Io. (see Proceedings of the Academy of natural sciences, 1867–78, Davenport, Io., vol. i. p. 177). This may be found much nearer.

It is precisely at its youngest age that the life of the insect is best protected. An egg, according to Reaumur and others, will endure a cold of 50° below freezing, and the boiling-point of water in heat, without losing its vitality. In this age there being no means of defence or escape, a species would soon be destroyed without these natural means of resistance. After hatching, the larvae are dispersed, and conceal themselves in places resembling them in color, until the survival of the species is assured. Nature always furnishes efficient protection when most needed.

Before taking up the Orgyia larva, we wish to speak of a parasite which we discovered, — an inoffensive dipterous insect, all of whose metamorphoses we have studied, which would soon destroy the larvae, if the sparrows, in their turn, did not become the persistent and greedy devourers of said parasite.

At the two seasons of the year when the larva makes its appearance in New York, this dipterous insect is on the watch, and as it crawls along the ground deposits an egg in the midst of its hairy covering. Toward the end of winter or beginning of spring the dipterous larva is developed at the expense of the Orgyia pupa. Then, instead of a moth being hatched, appears an active fly with extended wings, large enough to be observed by the naked eye. Precisely at this moment the sparrows hunt them, devouring great numbers, which, if allowed to multiply by this strange manner of hatching, would soon much reduce the number of the Orgyia, if they did not completely destroy the species. Here comes in the reflection that the sparrows are now not only useless, but actually aid in the multiplication of the destructive Orgyia.

But not to completely ostracise these noisy and vivacious strangers from the land where, with so many of my countrymen, they have been so hospitably received, let them remain as long as the people care to protect them; inasmuch as, without disturbing them in their picturesque dwellings, there is a way of destroying the Orgyia, by an anodyne and easy process, doing no harm either to plants or animals, nor to the visitors of the beautiful parks of the city. Nothing is more disagreeable to the fair promenaders than to feel upon the neck, see suspended from their head-dress or hair, or crawling over their dresses, these little creatures, interesting to the scientific observer, but causing a shudder to them.

The larvae of Orgyia know well the laws of aerostation, and the use of the parachute. M. Capronnier of Belgium, a few years ago, in the month of October, made this singular observation on the method of their dispersion. It must be remembered that the females of Orgyia are wingless, — a character which distinguishes them from the genus Liparis, in which the females have wings. The question was asked how the Orgyia could gain access to an enclosure newly cultivated. M. Capronnier replied that he had seen the small larvae emerge from eggs laid in the cocoon of Orgyia. They made a thread from which they suspended themselves free in the air, when the wind carried off the larvae with the thread, no doubt to great distances, and they very soon disappeared. This mode of dispersion is similar to that observed in some spiders.

The genus Orgyia was established by Ochsenheimer, and belongs to the Bombycidae, or those whose larvae make cocoons from their own hairs, or particles of earth hardened by a salivary secretion, etc. The adults are of small size. The males, of rich colors usually, fly rapidly in full sunlight; the antennae wide, bipectinated, doubtless with an acute sense of smell, which guides them to the females. The last are five or six times as large as the males,

heavy, full of eggs, motionless, having not even an embryonic trace of wings. The larvae which are to become males, beside some differences in colors, are much smaller as pupae than those which are to become females. As soon as the perfect stage arrives, the males commence their flight, while the females simply emerge from their cocoon, on which they remain, attracting the males by an odor which they emit, inappreciable to our senses, but shown to exist by the fact that the males will enter an apartment in which a female is imprisoned in a tin or wooden box. The males move their antennae vigorously during flight, often bending them forward, and approach the windows. If these be closed, they go around the house in search of an entrance: they have even been known to descend the chimney.

Pairing is accomplished in a very rough manner. Among many Sphingidae the males approach gently, attract attention, departing and returning in circles, gradually diminishing, until union takes place; but in these the contact is rude, almost brutal, and the female, after the departure of the male, remains motionless, and begins to lay her eggs on the cocoon. O. antiqua, of France, lays its eggs near the cocoon, where they become attached by a secretion which covers them as they are laid. O. gonostigma lays her eggs near the cocoon, taking hairs from its body to make a bed for them, in alternate layers of hairs and eggs, till all are deposited, to the number of about three hundred. The New York species covers the eggs with a white viscid secretion, solidifying in the air, resembling the mucus of the snail and slug. The eggs are generally pretty, at first round, then indented at the top like a goblet or cup, sometimes with a rose-colored ring (in O. antiqua), sometimes of a porcelain-white tint (in O. vetusta).

The larvae escape from the egg by eating through the bottom, where the holes for fecundation are placed. They do not disperse themselves widely. As they live on trees and shrubs, are not large, and eat little individually, they may be numerous upon a single plant. Moreover, almost all are polyphagous, or will eat many different kinds of plants. In France, however, the O. ericaea lives only upon heaths, and the O. trigotephras on a species of oak.

Some species have several broods a year. The O. antiqua, in Paris, like the New York species, appears in June, and sometimes in October; others have only a single brood; but this cannot be made use of in classification or physiology. A given species may have but one brood in the north of Europe and America, and two in the south; and even in Paris and New York, when September is very warm, a second brood may appear, which would not occur in many other Lepidoptera. In captivity, also, the absence of cold nights changes the epochs of their appearance, besides favoring the development of a second brood.

Linnaeus says that the male of the Orgyia, knowing by instinct that the wingless female is powerless to move far, when he finds her on a wall or plant, flies away with her during pairing, and carries her to a place where the young may obtain food. This we have never seen, and never expect to, as the males are entirely too small and feeble to carry off the much greater bulk of the female. We need not say any thing here of the O. detrita, which resembles much the O. vetusta or leucostigma, and may be the same species. LE METAYER DE GUICHAINVILLE.

New York, March 22.

## Fossils from Kicking Horse Pass.

I have to-day received the following very interesting communication from Professor Lapworth, on the result of an examination he has kindly made for the survey, of a collection of graptolites from the Rocky Mountains, in the vicinity of the Kicking Horse Pass.

ALFRED R. C. SELWYN.

Geol. surv. Can., March 15.

I have recently examined the fossils collected by R. G. McConnell, geological survey of Canada (1886), from the dark, slaty shales of the Kicking Horse Pass, Rocky Mountains. There are few species in the fairly large collection, but the forms are generally well preserved, and the fauna represented is a distinctly typical one. The following are the species I have identified: —

(A) Family Dichograptidae.
- (1) Didymograptus, sp. nov., allied to Didymograptus enodus Lapworth from the Llandeilo beds of Abersiddy Bay, South Wales (see *Quart. journ. geol. soc.*, 1875, plate 35, figs. 1*a*, 1*b*).

(B) Family Glossograptidae.
- (2) Glossograptus ciliatus Emmons.
- (3) Glossograptus spinulosus Hall.

(C) Family Diplograptidae.
- (4) Cryptograptus tricornis Carr or C. marcidus Hall.
- (5) Diplograptus angustifolius Hall.
- (6) Diplograptus rugosus Emmons.
- (7) Climacograptus coelatus Lapworth.

There are also a few other forms, doubtful.

*Species of Phyllograptus or Lasiograptus, etc.*

The fact that these graptolites have been obtained from the distant region of the Rocky Mountains gives them an especial interest, as few graptolites have hitherto been noticed from that region. The only notice of graptolites from the western states known to me is that given by Dr. Charles White in vol. iv. ('Palaeontology') of the 'Report of the geological survey of the hundredth meridian.' Four forms are described by him (*loc. cit.*, pp. 9, 10, *et seq.*) as having been obtained from some beds of partially metamorphosed shale five miles north of Belmont, Nev. No fossils were found associated with them that might assist in the determination of their exact age; and they were provisionally referred to the geological date of the Utica slate of New York state.

These graptolites from the Kicking Horse Pass, under notice, may also be referred to the age of the Utica slate, or at any rate to the Trenton. In the Utica fauna of the United States and Canada the association of forms is just such as occurs in the Llandeilo (lower and middle) of Britain, and some of the forms are common to both sides of the Atlantic.

. . . . . . . . . . . . . .

It is curious that none of the family of the Dicranograptidae (Dicranograptus and Dicellograptus) are represented in this little collection. It is just possible that it may therefore be somewhat older than the typical Norman's Kiln beds, where the Dicranograptidae are exceedingly abundant. Neither have we any of the peculiar genera of the Leptograptidae (Coenograptus and Leptograptus, etc.) so prevalent in the Norman's Kiln horizon everywhere. Thus it is by no means unlikely, judging from the evidences at present at our disposal, that the fauna of the shales of the Kicking Horse Pass come from strata answering broadly to the British lower Llandeilo: they are distinctly newer than the Point Levis beds, and belong to the second Ordovician fauna, but in all probability to the oldest zones of that fauna.

CHAS. LAPWORTH.

Mason college, Birmingham, March 7.

**Publications received at Editor's Office, March 21-26.**

ALLEN, G. Common sense science. Boston, Lothrop. 318 p. 12°. $1.50.

CHAMBERLAIN, B. H. Memoirs of the Literature college, Imperial university of Japan. No. 1: The language, mythology, and geographical nomenclature of Japan viewed in the light of Aino studies. Tokyo, Imp. univ. 174 p. 4°.

CRANK, the. Vol. i. No. 1. Ithaca, N.Y., Andrus & Church, pr. 12 p. 8°.

CROOKES, W. Genesis of the elements. London, Roy. inst. 28 p. 8°.

HAMBLETON, G. W. The scientific prevention of consumption. London, J. & A. Churchill. 16 p. 12°.

—— What is consumption? London, J. & A. Churchill. 64 p. 12°.

MURRAY, J. A. H. A new English dictionary on historical principles. Part iii.: Batter-Boz. Oxford, Clarendon pr. [336] p. f°. (New York, Macmillan, $3.25.)

RAGS, report of the special committee on the disinfection of. (Trans. Amer. pub. health assoc) Concord, N.H., Repub. pr. assoc. 30 p. 8°.

U. S. BUREAU of navigation. List of lights on the east and west coasts of North and South America, including the West India and Pacific Islands. Corrected to 1887. Washington, Government. 267 p. 8°. 25 cents.

U. S. HYDROGRAPHIC office, catalogue of charts, plans, sailing directions, and other publications of the, 1887. Washington, Government. 101 p. 8°.

WOOD, H. Natural law in the business world. Boston, Lea & Shepard. 222 p. 16°. 75 cents.

YALE university, studies from the laboratory of physiological chemistry, Sheffield scientific school of, for 1885-86 Ed. by R. H. Chittenden, Ph.D. Vol. ii. New Haven, Tuttle, Morehouse, & Taylor. 236 p. 8°.

**Calendar of Societies.**

*Philosophical society, Washington.*

*March* 26. — Bailey Willis, Mount Rainier and its glaciers; Marcus Baker, What is a topographical map? H. A. Hazen, Relation between wind-velocity and pressure; H. Carrington Bolton, The counting-out rhymes of children, their antiquity, origin, and wide distribution.

*Engineers' club, Philadelphia.*

*March* 19. — Wilfred Lewis, Phosphor-bronze wire for helical springs; John L. Gill, jun., Screw-threads; H. H. Sintzenich, Description of a rail chair; F. H. Lewis, The Clapp-Griffiths steel for structural work; Emile Low, Maps for railroad surveys.

*Natural science association, Staten Island.*

*March* 12. — Mr. Kunhardt, Natural gas as it occurs in Pennsylvania; Charles Keutgen, Staten Island elevations, above the level of the bay; Mr. Davis, Memoranda upon the large trees of Staten Island.

*Society of arts, Boston.*

*March* 24. — Gen. Francis A. Walker, The source of business profits.

*Royal meteorological society, London.*

*March* 16. — D. W. Barker, Notes on taking meteorological observations on board ship; H. R. Mill, Marine temperature observations.

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# SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 1, 1887.

## *THE AMERICAN WHALE-FISHERY, 1877–1886.*

THE American whale-fishery reached its flood-tide of prosperity about the middle of the present century. In 1846 the fleet numbered 722 vessels, valued, with outfits, at nearly \$20,000,000. The most valuable catchings were in 1854, when the oil and bone secured were worth \$10,766,521. The largest annual yield of sperm-oil was in 1837, 5,329,138 gallons, averaging \$1.24¾ per gallon; of whale-oil, in 1851, 10,347,214 gallons, averaging $45\frac{5}{16}$ cents per gallon; and of whalebone, in 1853, 5,652,300 pounds, at 34½ cents (gold) per pound.

In 1877 the whaling-fleet numbered 163 vessels, hailing from the following ports: New Bedford, Mass., 118 vessels; Provincetown, Mass., 21; Boston, 6; Edgartown, Dartmouth, Fairhaven, Marion, and Westport, Mass., 12; New London, Conn., 3; San Francisco, 2.

In 1886 the fleet cruising in the North Pacific and Arctic had very largely transferred its headquarters and ownership from New Bedford to San Francisco. The hailing-ports of the fleet during this year, numbering 124 vessels in all, were as follows: New Bedford, 77 vessels; Provincetown, 12; Boston, 3; Edgartown and Marion, 4; New London and Stonington, 6; San Francisco, 22.

The distribution of the fleet in 1886 was as follows: 48 vessels, mostly schooners, cruising in the North and South Atlantic; 39 vessels, the largest and best in the fleet, cruising in the North Pacific, Bering Sea, the Arctic north of Bering Strait, and in the Japan and Okhotsk seas, pursuing the bowhead and the Pacific right whale; 2 vessels in Hudson Bay in search of the bowhead; 20 vessels cruising, chiefly for sperm whales, in the South Pacific and Indian oceans. Thirteen vessels were detained at home ports throughout the year, leaving the active fleet only 111 sail.

The business is carried on by forty-nine firms and general agents, with headquarters chiefly at New Bedford and San Francisco.

The following tables show the condition of the industry during the last decade. There has been a steady decrease in the number and tonnage of the vessels. The annual yield of sperm-oil has greatly decreased. The yield of whale-oil, which includes oil of walrus and of all cetaceans other than sperm whales, varied greatly from year to year. The value of sperm-oil from 1877 to 1886 averaged 92 cents per gallon; whale-oil, 47½ cents per gallon; and whalebone, \$2.44 per pound.

*Number and tonnage of vessels, and value of oil and bone.*

| Year. | Number of vessels. | Tonnage of vessels. | Value of catchings. |
|---|---|---|---|
| 1877 | 163 | 40,593 | \$2,309,569 |
| 1878 | 179 | 39,700 | 2,232,029 |
| 1879 | 178 | 40,028 | 2,056,069 |
| 1880 | 173 | 38,408 | 2,659,725 |
| 1881 | 177 | 38,551 | 1,926,620 |
| 1882 | 161 | 36,802 | 1,861,779 |
| 1883 | 147 | 34,000 | 1,891,716 |
| 1884 | 144 | 33,119 | 2,542,614 |
| 1885 | 133 | 31,207 | 2,456,064 |
| 1886 | 124 | 29,118 | 1,792,657 |

*Number of barrels of oil, and pounds of whalebone taken.*

| Year. | Whale-oil. | Sperm-oil. | Whalebone. |
|---|---|---|---|
| 1877 | 27,191 | 41,119 | 160,220 |
| 1878 | 33,778 | 43,508 | 207,259 |
| 1879 | 23,334 | 41,308 | 286,280 |
| 1880 | 34,776 | 37,614 | 464,028 |
| 1881 | 31,650 | 30,600 | 368,000 |
| 1882 | 23,371 | 29,884 | 271,999 |
| 1883 | 24,170 | 24,595 | 254,037 |
| 1884 | 24,670 | 22,670 | 426,968 |
| 1885 | 41,586 | 24,203 | 463,990 |
| 1886 | 27,249 | 23,312 | 352,490 |

The two principal branches of the industry are the sperm-whale and the right-whale fisheries. Vessels engaged in sperm-whaling are sometimes employed 'between seasons' in the capture of humpback whales. The right-whalers take the bowhead or polar whale and the ordinary right whale of temperate waters. They also capture walrus for the oil and ivory.

About one half the tonnage of the fleet, including most of the smaller vessels, is employed in sperm-whaling, and the other half in right-whaling. More than fifty per cent of the sperm-oil is taken in the Atlantic Ocean, and about three-fourths of the whale-oil comes from the Arctic.

Sperm whales are very widely distributed in temperate and tropical waters. They have been taken as far south as the 50th parallel of latitude in the Atlantic and Pacific, and as far north as latitude 56° 12′ in the North Pacific. They are generally taken in deep water, though sometimes captured in the more shallow waters at the edge of the great ocean-banks. They are smaller within thirty degrees north and south of the equator than in higher latitudes. The fishing-grounds for sperm whales are widely separated. In the North Atlantic good sperm-whaling has been found in the Caribbean Sea, in the Gulf of Mexico, and in various places about the West Indies, the Bahamas, and the Azore Islands. Among the most important regions are the 'Charleston ground,' in latitude 29° to 32° north, and longitude 74° to 77° west; and the 'Hatteras ground,' along the edge of the Gulf Stream, in the latitude of Cape Hatteras. Other resorts are the 'Two forties' and 'Two thirty-sixes,' situated at the crossings of the 36th and 40th parallels and meridians. There have been important grounds from latitude 48° to 54° north, and longitude 23° to 32° west.

In the South Atlantic, sperm whales are now taken chiefly along the African coast and between the coast and St. Helena. Very profitable whaling was formerly found along the South American coast.

The South Pacific grounds for sperm whales are off the Chilian coast, extending from latitude 35° to 46° south, and from the coast 200 miles off shore. North of here are the 'Archer ground,' the 'Callao ground,' and other resorts. Throughout the South Pacific there were formerly many other extensive and profitable cruising-grounds; but they are now nearly all abandoned, not entirely because of the scarcity of whales, but because of the low price of sperm-oil and the great expense attendant upon the long voyages to distant seas. A few vessels still cruise in the vicinity of New Zealand and Australia, and in some seasons make good voyages.

In the North Pacific, also, sperm whales were formerly taken on various grounds along the coast of Lower California, and on the once famous 'Japan ground,' extending across the ocean along the 30th parallel, and especially between latitude 25° and 40° north, and longitude 140° to 180° east. For several years no vessels have been fitted for sperm-whaling in those waters; though Arctic vessels on their way north, after their spring cruising, have reported these whales in abundance.

The Indian Ocean was once the scene of an extensive fishery for sperm as well as right whales, but very few vessels have gone there during the last ten years. In 1880 there was no American whaling-vessel in that ocean; in 1886 two vessels went there, with fair success. Sperm whales were found principally off Port Dauphin, around Madagascar, about Mauritius, Bourbon, and Roderique islands, the Amirante group, off Zanzibar, and elsewhere along the African coast to the Red Sea.

Right whales (Eubalaena) are found as far north as latitude 61° 30′ at the mouth of Hudson Strait, and south to the Antarctic Ocean, though they are not common in tropical waters. These are also called 'black whales,' to distinguish them from the bowhead or polar whale (Balaena mysticetus), which by English whalers, and often by others, is confounded with the right whale. The bowhead is an ice whale, found only in Arctic regions, while the other species inhabit temperate waters.

The principal resorts of the right whale east of America are in the South Atlantic, while in the Pacific they are about equally abundant both north and south of the tropics. These whales were formerly taken along the New England coast, but they are now only occasionally captured in the North Atlantic. During the winter months whalers find them on the Hatteras ground and in the Gulf of Mexico and Caribbean Sea, and a few vessels have met with indifferent success in searching for them along the west coast of Africa between latitude 15° and 23° north.

In the South Atlantic they are sought for around the Tristan Islands and along the South American coast, where they were once very abundant.

The Indian Ocean was once an important right-whaling ground, but is now practically abandoned.

In the South Pacific, right whales are taken from September to January, off the coast of Chili, on the grounds from latitude 42° to 47° south, and longitude 75° to 80° west, and in the spring farther north and nearer the coast.

The North Pacific right-whale grounds were once famous, and were cruised over by upwards of two hundred American vessels. The principal resorts were the 'North-west coast' or 'Kadiak ground,' off the Alaska Peninsula, and in the Japan and Okhotsk seas. After the discovery of the whaling-grounds in the Arctic, the lower latitudes were gradually abandoned. A few vessels, however, have within a few years past again resorted to the Kadiak, the Okhotsk, and the Japan grounds.

Humpback whales are found within the parallels of 60° north and 70° south. They are taken chiefly in shallow water within certain bays and along the coast. The island of Trinidad and Gulf of Para, also the Cape Verde Islands, and the African coast from 3° to 7° south latitude, and about the West Indies, are the principal grounds in the Atlantic. Some years these whales are quite abundant along the New England coast and on the off-shore fishing-banks.

In the Pacific these whales are found along the South American coast, particularly in the Bay of Panama and in the Gulf of Guayaquil, and along the Californian coast. They are also found as far north as the Aleutian Islands, where the natives capture them.

The California gray whale, or devil-fish (Rhachianectes glaucus), is found only in the North Pacific, and is an object of pursuit by the shore stations established along that coast.

Finback and sulphur-bottom whales are quite universally distributed ; but, their blubber yielding comparatively little oil, they are not often captured except by shore parties along the Californian coast, at Cape Cod in New England, on the northern coast of Norway, and at Iceland.

Bowhead whales, as stated above, are confined to icy waters. The Atlantic-Arctic fishing-grounds are in Davis Strait, Cumberland Inlet, and Hudson Bay. American vessels formerly cruised as far north as Pond's Bay, in about latitude 73°, but they now seldom go beyond latitude 65°. Scotch whaling-steamers, however, cruise as far north as 75°, their northern range being limited only by dangers from ice.

The Pacific-Arctic resorts of the bowhead are in Bering Sea and north of Bering Strait. About three-fourths of the whale-oil and nearly all the whalebone landed by American whaling-vessels is taken by the North Pacific fleet, so called, cruising north of Bering Strait and in the Okhotsk Sea. The vessels in this fishery are the largest and best equipped in the whaling-service. In 1879 or 1880, steamers were first used in this fishery, and now about one-fourth of the fleet are of this class. They can push their way with less danger than sailing-vessels amid the ice-floes, and, as a rule, thereby secure a greater catch. The Arctic vessels have their headquarters at San Francisco. They leave for the north about March 1, in season to meet the ice in Bering Sea, and to push gradually northward with it. Usually about May 1 to 10 a few whales are overtaken on their northward migrations, and as fast as the ice permits, the vessels crowd their way in pursuit. Until about June 1 the fleet cruises along the Siberian coast, capturing as many whales as possible. Those which are secured form only the 'fag-end' of the 'herd,' most of the whales having moved northward before the vessels could overtake them. As soon as the ice allows, the vessels push their way through the Strait, ever alert to catch the whales which are hurrying to the far north. From the middle of June till the latter part of July few whales are taken. During this time, while waiting for the return of the bowheads, the whalers devote their time to capturing walrus, which are valuable for both ivory and oil. About the beginning of August the fleet moves eastward and northward to Point Barrow and beyond, capturing whales wherever they can be found, though but very few are seen until the southward migration begins, in the latter part of the month. From this time till the latter part of September or early in October, when the season closes, there is great excitement and eagerness to secure as many whales as possible.

The early departure of the animals to inaccessible regions among the ice, and the anxious weeks spent in awaiting their return, make this ground one of the most exciting regions that whalemen can find, and the surroundings are of more than usual interest. Nothing can exceed the daring and pluck of the whalemen in their endeavors to search out and capture their prey. Forgetful of surrounding dangers, they pursue the spouting animal far up among the ice-floes ; and many a vessel has been crushed to pieces by the ice as she was tracking out a whale. Anxious to secure full fares, they remain amid the freezing waters until early winter stares them in the face, when they plough their way homeward. Several disasters have overtaken the fleet in their zeal to catch the whale, as in 1871, when thirty-five noble craft were left at anchor in sight of certain destruction ; the crews, after arduous labor, saving themselves with their boats.

Not always are the whalemen thus fortunate in escaping with their lives. In 1879 two vessels became separated from the fleet, and were never after heard from. Nearly every year one or more vessels are caught in the ice and ground to splinters. In Hudson Bay and Cumberland Inlet, also, the vessels are exposed to dangers from ice. From 1846 to 1880, eighteen vessels were wrecked in those waters. The fleet is not as large as that cruising north of Bering Strait, nor are the vessels generally so large and so well equipped. Several vessels have passed the winter 'locked in the ice,' in Hudson Bay or in Cumberland Inlet, and have thereby taken advantage of the early and late weeks of the whaling-season, besides securing bear, musk-ox, and seal-skins during the winter months.

| Year. | Number of vessels. | Barrels of oil. | Pounds of whalebone. | Pounds of walrus ivory. |
|---|---|---|---|---|
| 1877 | 19 | 17,530 | 153,800 | 74,000 |
| 1878 | 17 | 13,080 | 114,200 | 30,000 |
| 1879 | 21 | 18,800 | 200,500 | 32,900 |
| 1880 | 19 | 26,700 | 409,000 | 15,300 |
| 1881 | 23 | 24,740 | 387,000 | 15,400 |
| 1882 | 32 | 22,975 | 360,500 | 17,800 |
| 1883 | 38 | 10,155 | 159,400 | 23,100 |
| 1884 | 39 | 20,450 | 318,700 | 5,421 |
| 1885 | 40 | 24,844 | 451,068 | 6,564 |
| 1886 | 44 | 20,307 | 332,931 | 5,273 |

The foregoing table shows the extent of the Pacific-Arctic fishery from 1877 to 1886. The number of whales secured each year varies greatly. In 1880, 265 were caught; in 1885, 222; and in 1886, only 153. The 'whale' oil includes also oil of walrus.

A. HOWARD CLARK.

## ICE AND ICEBERGS.

IN a paper read before the Royal society of Canada (May 27, 1886), 'On some points in reference to ice phenomena,' Dr. Robert Bell discusses various observations on the formation of ice and its action on the land. The rapid disappearance of icebergs after they have passed the banks of Newfoundland, he ascribes to the difference in temperature of the Gulf Stream and the interior of the berg, which is probably much colder than 0° C. He supposes that the rapid increase of the temperature of the water causes the ice to crack; and this process, once started, would rapidly continue as the colder parts of the interior come in contact with the water. An experiment made at Ottawa proved that ice, on coming in contact with warm water, really cracks. Though the difference in temperature may take an active part in fracturing icebergs, some other facts ought to be investigated before it is possible to decide on this question. The icebergs of the Labrador current show, even while in Baffin Bay, many signs of decay. The most remarkable ones are the deep grooves hollowed out by the waves breaking at the foot of the icy cliffs. The depth of these excavations and the amount of *débris* scattered around the berg prove the efficacy of the waves in breaking up the berg. However, the greater part of the year the bergs are embedded in pack-ice, and protected from the action of the swell. This continues as far as the Labrador coast. As soon as the berg reaches the southern end of the pack-ice, the breakers formed by the Atlantic swell will undermine its cliffs, the *débris* furthering their action. The history of icebergs may well be observed in Baffin Bay. The greater number are flat, and shaped like a table, having a flat top and vertical edges. They attain a size of from twenty-five to thirty square miles, and are about four hundred feet thick, their height above the water being fifty feet. These masses of ice, on striking a rock or a shoal, are broken up into small pieces, all of which have vertical edges. A very few of these are tilted, the horizontal top becoming inclined and partially submerged. Thus some parts of the berg attain a far greater height than they had before the tilting, and it is probably thus that the high and pointed icebergs originate. Flat bergs are very stable, while pointed ones show signs of frequent tilting and capsizing. Grooves which were excavated by the swell may be seen in all parts of the berg, some of them even running vertically. Sometimes many parallel grooves prove that large pieces of the unsubmerged part of the berg broke off, and that it gradually emerged from the ocean. Grooves diverging from one edge are of frequent occurrence, and were caused by the lifting of one side of the berg. It would be of great importance to know whether the tilting has any influence upon the direction of the cracks and fissures. These are always vertical while the bergs are in their original position. There are no observations which would enable us to decide whether the same direction is maintained after the tilting, which would be of eminent influence on the breaking-up of the iceberg. If, after the tilting has occurred, inclined faces would originate, this would materially contribute to a rapid destruction. As even small pieces of the large bergs have vertical edges, their direction is probably due to the structure of the ice, and will be maintained in any position the ice may have.

Bell remarks that the amount of rocky and earthy material carried from north to south by bergs is not very large. Field-ice, on the other hand, particularly such as is formed in shallow bays with high tides, and near the land, always carries great quantities of mud and stones, which are carried upon it by the wind or avalanches. We do not think that any amount of material is carried upon the ice by torrents formed by the melting of snow, as Bell supposes. The ice always contains some salt, and, as the melting-point of the fresh water coming from the land is higher than that of the ice, the latter is rapidly wasting at the mouths of the rivers.

In regard to the formation of Frazil (anchor) ice,

Bell is in favor of the hypothesis of Dr. Sterry Hunt, who regards it as due to terrestrial radiation, and analogous to the formation of hoar-frost on the surface of the ground in clear weather. A similar opinion was held by Arago, but this theory does not explain all the phenomena; and the views of Zschokke, that the anchor-ice is formed on the surface and carried to the bottom by the current, seem to agree better with the facts. C. W. Weber and J. Rae agree with this theory. It is doubtful whether water is so diathermal for dark rays that the radiation should have any effect on the formation of anchor-ice.

Of great interest are Bell's remarks and observations on the long fissures which remain open throughout the winter. He proves that the changes of temperature have no influence upon their width. They form every winter in the same situations, and generally between the extremities of points on opposite sides of the water. He considers it probable that the progressive lowering of the water going on during the winter produces a tension on such places sufficient to keep the fissures open.

Finally, Bell explains the remarkable rings and dikes of bowlders caused by the action of the ice. In ponds which freeze to the bottom, bowlders are incorporated in the ice. As the ice is evaporating at its surface, while accessions of water lift the ice, the bowlders are raised and gradually carried toward the periphery. On large lakes the drifting ice is pressed against the shores, and thus forms dikes of bowlders.

## *MÜLLER'S SCIENCE OF LANGUAGE.*

THE appearance of the concluding part of Dr. Müller's great work on linguistic science, which has occupied ten years in its publication and of course a much longer time in its preparation, affords a good opportunity for considering this important contribution to science as a whole. In speaking of it as concluded, however, the term must be understood as applying to the original plan, which contemplated only three volumes. In this sense, the author regards his work as completed. But, as we learn from the preface to the latest portion, he purposes adding two supplementary volumes, one of which will be occupied with the analytic and the so-called 'mixed languages,' as well as with new idioms, extinct and living, of undetermined position, while the other will comprise the materials which have accumulated during the past ten years.

Like the other inductive sciences, — and perhaps even more than the majority of them, — comparative philology has been a rapidly growing science. No better evidence of this fact can be found than in the comparison, to which the author himself invites us, of his work with that of his noted predecessors, Professors Adelung and Vater, whose well-known 'Mithridates' presented the first general survey of languages ever attempted on a scientific plan. That great work, of which the last volume appeared in 1817, is justly deemed a monument of erudition and laborious research. The authors undertook to give an account of all known languages, with (wherever practicable) the Lord's Prayer as a specimen of each, translated and carefully analyzed. The work was as well accomplished as was possible at the time. But the necessary materials were to a large extent lacking, and the principles of the science were imperfectly understood. During the sixty years which have since elapsed, the progress of research has not only added largely to the data, but has developed many laws of the science, and in a great measure revolutionized its character. Exploring expeditions, missionary labors, and the study of ancient monuments have more than doubled the number of known idioms. At the same time, the profound investigations of many eminent scholars, in Europe and America, have elucidated the principles which lie, or seem to lie, at the foundation of the science. Some qualification is necessary in this statement, for in the science of language, as in other sciences, new discoveries are constantly appearing, which alter materially the aspect of what was deemed to be established truth. Not the less, however, is it certain that a vast progress has been made since the time of Adelung and Vater. Some able and practised hand was needed to gather up the immense mass of scattered material, and to frame a structure which should represent the present condition of the science, and make a solid platform on which other inquirers might safely build. No one, certainly, could be better fitted for this office, by experience and talent, than the distinguished scholar to whom we owe the linguistic portion of the history of the Novara expedition, and the well-known 'Algemeine Ethnographie,' which has long been a standard work.

In the brief preface to his first volume, Dr. Müller remarks that his work is designed specially for the use of academic lecturers and for students who desire the means of self-instruction. He has therefore purposely avoided the more popular and discursive method of books intended merely for general reading, and has adopted in preference the concise and systematic form of treatises devoted to the exact sciences. Throughout the greater portion of his work he has adhered strictly

*Grundriss der sprachwissenschaft.* Von DR. FRIEDRICH MÜLLER. Vienna, Alfred Holder; London, Trubner. 8°.

to this scientific method, which, as he justly considers, can alone give to such a work a permanent value. In the introduction, however, which occupies about a third part of the first volume, he has allowed himself more freedom, and has entered into many disquisitions which will interest the general reader, and will doubtless evoke much discussion and some dissent. He treats of the aim and limits of linguistic science; of the relation of speech to thought; of the origin of language, including the great question of the unity or plurality of beginnings; of the development of speech; of its material and formative parts; of the proofs of kinship among languages; of their classification, according to the various systems which have been proposed by philologists; of the elements of speech, — the root, the word, the sentence; of articulate sounds (phonology); of the expression of thought by writing, and of the influence of writing on the development of language. This list of topics is much abridged, and gives only an imperfect idea of the many subjects on which the author touches in this important introduction, in which he has condensed the conclusions of long-continued study and profound analysis.

In his classification he has sought to combine the ethnological and philological methods, and thus to link his earlier 'General ethnography' with the present work. The attempt was a natural one, but cannot be said to be altogether successful; and it is easy to see that the author himself, whose candor throughout is transparent, was finally not altogether satisfied with it. In the classification of races he selects (as in his 'Ethnography') the hair as the best criterion. He divides all mankind primarily into two classes, — the 'woolly-haired' (*ulotrichi*) and the 'smooth-haired' (*lissotrichi*). Each of these classes is again subdivided into two divisions. The woolly-haired class comprises the 'tuft-haired' (*lophocomi*) and the 'fleecy-haired' (*eriocomi*); while the smooth-haired races comprehend the 'straight-haired' (*euthycomi*) and the 'wavy-haired' (*euplocomi*). Other high authorities, including St. Hilaire, Bory de St. Vincent, and Huxley, have adopted the hair as the best primary characteristic for distinguishing the races. But while the epithets drawn from it are excellent descriptive terms, they are found in practice, like those derived from the shades of color and the shape of the head, to be far too wavering and uncertain to serve the purposes of a true scientific classification. Such is the conclusion of Prichard, Peschel, Quatrefages, Wilson, and other able ethnologists who have tested these methods.

To this opinion Dr. Müller's own matured views plainly tend. Though he formally preserves throughout his work — evidently for the reason that has been suggested — the four classes distinguished by the hair, he practically deserts this classification for that which his studies and philosophical insight have convinced him to be the only satisfactory and proper one,—at least for a philological treatise,—namely, the genealogical classification, based on the distinction of linguistic stocks. These stocks are, in fact, in comparative philology, what the elementary substances are in chemistry, — the sole and sufficient ground of a true scientific classification. The question of the origin of these stocks, or linguistic families, is too extensive and too much contested to be here considered; but that their distinction and determination constitute the primary element and foundation of linguistic science is a definite conclusion, for which the high authority of Dr. Müller may now be claimed.

The main body of the work consists of careful analyses of the phonetic and grammatical systems of all the languages whose sounds and grammar are known. In most instances — and, in fact, wherever compositions in the language are found — specimens of the text are given, with interlinear translations, and with annotations explaining every grammatical peculiarity. Such translations are, of course, the best test of the author's knowledge of the language. The labor required to master so completely the intricacies and peculiarities of this large number of idioms — from the monosyllabic Chinese and Anamese, with their variety of tones and positions, to the multitudinous inflections of American tongues — must have been enormous; nor would mere industry have been sufficient, without large experience, and what may fairly be termed linguistic genius. The first volume comprises the languages of the woolly-haired races, and is devoted almost entirely to the African tongues. The single exception is the Mafōr language, spoken on the north-west coast of New Guinea. The Mafōr people are not more woolly-haired than many other tribes of Melanesia. But as the latter speak 'mixed languages,' mainly of the Malaisian type, they are relegated to the 'Malayan race,' which is included among the smooth-haired races. Thus the classification by the hair breaks down on its first application; and we cannot be surprised that the author, hampered at the outset by his earlier ethnological theories, is glad, as his work proceeds, to escape from them, and restrict himself entirely to the genealogical classification.

The second volume opens with an interesting description and comparison of the very peculiar and in some respects highly organized Australian languages, which are shown conclusively to be-

long to a single stock, and not to be allied either to the Malayan or the Dravidian tongues, to which some authorities have sought to refer them. The languages of the 'hyperborean races,' extending along the arctic coasts, from the Yeniseean tribes to the Chukchi and the Eskimo, lead naturally to the proper American idioms. The discussion of these idioms must be deemed the least satisfactory portion of the work, not from any failure in the author's research or accuracy, but from the impossibility of condensing his materials into the limited space allowed for them. The linguistic stocks of this continent are at least twice as numerous as those of all the rest of the world. Their grammatical characteristics vary widely, and are of the highest interest. As Prof. Max Müller has well pointed out, these languages "can tell us quite as much of the growth of the human mind as Chinese, or Hebrew, or Sanscrit." Some of the stocks or families — as, for example, the Algonkin, the Dakota, and the Maya — comprise many distinct languages, which have been carefully studied and compared by some of the ablest philologists of Europe and America. In purely scientific value, apart from merely extraneous grounds of interest, the Algonkin family far surpasses the Hamito-Semitic stock. Yet while the latter occupies two hundred pages, the former is restricted to thirteen. It is as though, in a treatise on zoölogy, eighteen pages were given to the horse, as being a biblical animal, and only one page to the elephant. It must be admitted that in the present condition of linguistic science this discrepancy could not well have been avoided without making the work unwieldy and unsalable; and it is fair to add that the descriptions of the American languages, so far as they extend, are for the most part remarkable exhibitions of analytic skill.

A most admirable account is given of the great Malaisian family, which occupies, with the exception of the Australian and some Papuan tongues, the vast island world from Madagascar to Hawaii. This is followed by the languages of the 'North Asiatic' or Mongolian race, extending from Lapland and Hungary to Japan and the Indo-Chinese peninsula. The Nubian or smooth-haired African race succeeds, followed by the primitive languages of Hindostan, composing the Dravidian family. The greater portion of the third volume is occupied with the languages of the so-called 'Mediterranean race.' This is a purely geographical designation, including populations so widely distinct in physical traits and in language as the Indo-Europeans, the Hamito-Semitic nations, the Caucasian tribes, and the Basques. To these languages, which were the first to attract the attention of philologists, the author has devoted special care. The perplexing variety of Caucasian tongues is reduced by him to two, or at the most three, families. The curious and elaborate inflections of the Basque are analyzed and set forth with remarkable clearness. Those students of language who are accustomed — as too many are — to regard the whole of philological science as summed up in the two families of the Indo-European and the Hamito-Semitic stocks, will here find an example of an indefatigable and large-minded scholar, who can equal if not surpass them in their special studies, while his wider view embraces, as that of every thorough philologist should do, a knowledge of the chief characteristics of all the other families.

The work lacks an index, which will doubtless be furnished with the supplementary volumes. There is another and a much more important deficiency, which we may hope will be supplied in this forthcoming portion. In his survey of languages, the author has restricted himself almost entirely to idioms of whose grammar something is known. Those tongues of which we possess merely vocabularies are to him as though they did not exist. He does not even condescend to name them. In his view, the life of a language is in its grammatical forms; and only by the comparison of such forms can we be made certain that two languages are, or are not, akin. The first of these propositions is unquestionably true; the other is opposed to much evidence and to the author's own example. Gallatin's great work, the 'Synopsis of Indian languages,' owes most of its value to its comparative vocabularies; and his classification, based mainly on these vocabularies, has proved substantially correct. It is purely by lexical comparison that Dr. Müller has been able to establish the unity of origin of all the Australian tongues. No doubt this method has been greatly abused by incompetent writers. It needs to be applied, like all other tests, with scientific knowledge and caution; but, when so applied, it will be found entirely conclusive. Employing this method, the author will be able to give us, for the first time in the history of philological science, a nearly complete list of linguistic stocks, which, instead of the 'one hundred' mentioned in his introduction (p. 77), will probably be found to number nearly three hundred; and he will thus at length place this science on a truly philosophical basis. If to this he would add a series of language-maps, similar to those of which Mr. Cust, in his volume on the 'Modern languages of the East Indies,' has given us admirable examples, his work would be completed in a manner which would leave little to be desired. Even without these additions, the

three volumes, as they stand, form a compendium of the greatest value, indispensable to all who are engaged in any department of linguistic study.

H. HALE.

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PROFESSOR GAGE of Cornell university has recently issued a pamphlet consisting of notes on microscopical methods for the use of laboratory students in the anatomical department of that institution. They are designed to accompany the notes on histological methods which were published last year, and to give only the main facts and principles relating to the microscope and to its manipulation, which seem indispensable for the successful study of elementary histology. In these notes the microscope and its parts are described, and advice given as to its care, and also the care of the eyes, which are apt to suffer unless special precautions are taken to protect them. Professor Gage advises that both eyes be kept open, and the labor divided between the two eyes, using one eye for observing the image a while, and then the other. He recommends the use of an eye-screen made by pasting black velveteen on bristol-board. The body of the microscope is received in a hole cut in the middle of the length of the screen and nearer to one side. The eye which is not in use looks at the black surface, without any strain or injurious effect. The micrometer and its use are made clear, and a description given of the camera lucida and the methods of drawing the objects seen in the field of the microscope. The differences between adjustable and non-adjustable objectives, and their advantages and disadvantages, are concisely treated, as are also immersion objectives, and Zeiss' new apochromatic objectives. This name has been given to his objectives made of new kinds of glass. They are made adjustable and non-adjustable, dry, and for water and homogeneous immersion liquids. Altogether, Professor Gage is to be congratulated on having put a large amount of valuable information into a very small space, and that, too, without having sacrificed clearness of description. The figures, eleven in number, aid very materially in elucidating the text.

— Prof. John A. Ryder of the Biological department of the University of Pennsylvania has recently had a new microtome constructed. It cuts serial sections in ribbons, and is very compact, occupying a space of only eight inches by four. The sections produced are cut flat, and are not parts of a hollow cylinder. The thickness to be cut can be adjusted by a simple device, and ranges from $\frac{1}{10000}$ of an inch or .0025 mm. up to $\frac{1}{400}$ of an inch or .0625 mm. The knife, an ordinary razor, admits of being placed at any angle, as in a sledge microtome. The successive sections are cut as rapidly as the operator can move his right hand up and down through a distance of three inches. This new instrument was devised in order to provide a simple, compact tool, adapted to class-work, where many sections are required, and for embryological, histological, pathological, and botanical research, at far less cost than that of the best sledge microtomes, and, though constructed very differently from the latter, is equally accurate. Recently great improvements have been added, so that it can be used as a rapidly cutting, freezing microtome, or in cutting celloidin sections. With this new device, an object several inches in length may be embedded entire, as a single block, and cut up into a continuous series of sections by the ribbon method. Cutting a large block into a series of sections in this way is not possible with any other microtome yet devised. The range of capability of this new aid to research is therefore very great, and will doubtless be appreciated by teachers who wish to supply their pupils with an abundance of illustrative material, with a device fully three times as rapid in action as the Thoma made by Yung, and with all its capabilities for adjusting the knife and block. It is admitted by several competent histologists, who have examined it, to be the most practical instrument yet devised.

— Prof. J. Vilanova y Piera, of the University of Madrid, who has undertaken to edit a polyglot dictionary of geological and geographical terms, has invited Dr. John C. Branner, professor of geology in the University of Indiana, to take charge of the Portuguese part of that work. Besides the usual studies of the language, Dr. Branner has acquired a practical acquaintance with the Portuguese during two visits to Portugal and a residence of nearly eight years in Brazil, where he was assistant geologist upon the Imperial geological survey. In the preface to the Spanish part of the polyglot dictionary, Professor Vilanova y Piera says that such a work was first suggested to him by American geologists at a meeting of the International congress of geologists.

— The U.S. hydrographic office has published a complete list of the charts, plans, and sailing-directions that had been published up to the end of 1886. The catalogue will be a valuable book of reference to students of American geography. The supplements to the sailing-directions, which were issued in December, 1886, contain a collection of all the additional information which has from time to time appeared in U.S. 'Hydrographic notices' and 'Notices to mariners.'

# SCIENCE.

FRIDAY, APRIL 8, 1887.

## COMMENT AND CRITICISM.

THE DISCUSSIONS as to cocaine and its effects proceed with vigor, and, while no consensus of opinion seems to have been arrived at by medical authorities, yet the number of cases of the use of the drug that have been observed and studied is rapidly increasing, and will afford the ultimate investigator a large amount of material to go over. The Brooklyn physicians have lately taken a public stand in the matter, based on a paper by Dr. J. B. Mattison, which emphatically opposes the views expressed by Dr. Hammond and others, which have been heretofore commented on in these columns. The action of the Brooklyn physicians takes the form of the draught of a bill to be presented to the legislature, which places cocaine on the list of poisonous drugs to be sold only on a physician's prescription. In his paper, Dr. Mattison says that "no advent in the therapeutic arena during the last decade has been attended with such varied and extensive claims for favor as cocaine. Its marvellous effect in ophthalmic surgery roused a spirit of experimental research in other directions which has added largely to its well-proven power for good; but a potency for good implies a potency for harm, and the risk impends of its ardent advocates being carried by over-enthusiasm beyond the limit of a safe regard for the welfare of their patients or themselves that may imperil an otherwise well-founded success." He believes that the time has come when the evidence justifies a strong statement of the harmful effects of the drug; and, in combating Dr. Hammond's views, Dr. Mattison adduced fifty-one cases of the use of cocaine which attested a power in the drug, on some patients, that warrants caution with all.

Of the cases brought forward by the speaker, one was that of a young woman, twenty-three years of age, who died from an application of cocaine made during an operation for the removal of a tumor in the intestines. Another was the case of a man, aged thirty-three, to whose larynx a four-per-cent solution of cocaine was applied, and



who died from cocaine-poisoning after the second application. A third was the case of a woman in middle life, whose death resulted from the use of a four-per-cent solution for tooth-ache. Numerous cases were given of the poisoning resulting from the use of cocaine as an anaesthetic in surgical operations. Among the effects noted were depression of the brain, profuse sweating, impending syncope, difficult respiration, twitchings of the muscles, mania, paralysis of the heart, nausea, rigors, and so forth. Dr. Mattison further insisted that Dr. Hammond's assertion that there is no danger of cocaine addiction because he himself took half a dozen doses at intervals of from one to four days without 'acquiring a habit,' is valueless as evidence, because "cocainism is not the outcome of using the drug at long intervals. Its transient effect and the demand of an impaired nerve status compel frequent taking, — more than alcohol or opium, — so that habitués have been known to take it ten, twenty, or more times daily; and it is this — growing by what it feeds on — that tends to create and continue the disease." Dr. Mattison's own professional experience has proven for him two things, — first, that cocaine *quâ* cocaine possesses a pernicious power; and, second, it finds in the opium-taker a peculiar condition that specially favors its ill effects, making it for such patients peculiarly dangerous. In concluding his paper, the writer summarized thus: "Cocaine may be toxic, sometimes deadly, in large doses. It may give rise to dangerous or even fatal symptoms in doses usually deemed safe. The danger, near and remote, is greatest when given under the skin. It may produce a diseased condition, in which the will is prostrate and the patient powerless, — a true toxic neurosis, more marked and less hopeful than that from alcohol or opium.

Dr. Crothers, in the *Medical and surgical reporter*, gives the following statement of his views on cocaine: "Among alcohol inebriates and drug maniacs, cocaine inebriety is no doubt increasing. Its peculiar dangerous effects on the body will prevent its general use as an intoxicant to any great extent. It acts more rapidly than opium, but its effects pass off more quickly. Its first ef-

fect is more exhilarant than that of alcohol, but it is uncertain and variable. This stimulant action develops mania, followed by narcotism and melancholia. As an intoxicant, it is more dangerous than alcohol or opium. As a form of inebriety, it is more difficult to treat, requiring a longer time to break up, because of the physical and psychical complications. It cannot be used as a substitute for any other narcotic, or as an antidote or remedy." Dr. Hammond of New York finds, as the result of personal experience with cocaine, that two grains in a pint of wine produced all the beneficial and none of the deleterious effects of the drug. One grain injected hypodermically has an effect similar to that of two or three glasses of champagne. He thinks that cocaine has a refining and softening effect, while the tendency of alcohol is to lower the mental and moral tone, and to brutalize a man. Three grains produced a great disposition to talk, with vivid imagination. Writing was accomplished with great ease, and wonderful progress was made with a medical work which he was preparing. On the following morning he found the work to be composed of incoherent sentences and disconnected ideas, being utterly nonsensical. He subsequently took eight grains of the drug, which produced painful sensations.

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Dr. Frank H. Bosworth of New York has had considerable experience with cocaine. He says that in no single case of hay-fever which he has treated with it has he been able to detect any distressing reaction from its use. In a few cases the remedial effect has not been such as desired, but the proportion of such cases has been small. He has used cocaine in a hundred and fifty cases, and in but two was there any reaction, and in neither was this of a distressing character. Many patients have used the drug daily for eighteen months without any reaction, and without there being any toleration created, the same effect following its use at the end as at the beginning of the period, — complete relief. Being a sufferer from hay-fever, the doctor used the drug himself, applying it, in a solution of four per cent, to the nose. The relief was immediate and great, but lasted only from two to three hours. He used it frequently during the day in this way, at the beginning using from two to three grains daily. After using from half a grain to a grain, he experienced the full constitutional effects of the drug, which were a feeling of absolute peacefulness and repose, entire immunity from worry or care, thorough wakefulness, or, rather, alertness of intellectual faculties, with something of an indisposition to exertion. Together with this was an enjoyment of his cigar such as he had not experienced since he was a young man. In this way he would sit and smoke and read hours at a time. He soon found that he was taking from five to eight grains of cocaine daily. At night he would fall into a refreshing sleep, and awake in the morning without an unpleasant symptom. After breakfast, his hay-fever symptoms coming on, he would resume his cocaine. This he continued for more than two and one-half months; at one time, in order to test the drug, carrying the quantity as high as twenty-five grains between dinner and bed-time. In all, he used about an ounce of the alkaloid. His conclusions are as follows: 1°. The use of the drug produced no tolerance: two grains produced as marked a constitutional effect as twenty-five. 2°. No cocaine habit was contracted. At no time from the commencement of the experiments to the end of them was there ever the slightest craving for it. 3°. The local effect at the end of three months, in contracting the blood-vessels of the nose, was as quick and as efficient as at the time of the first application. 4°. There was not at any time the slightest local reaction following its use. 5°. In not a single instance was he able to detect any constitutional reaction after its effect passed away.

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We were in error last week in reporting that the sum of $400,000 had been appropriated by congress for the erection of a new naval observatory near Washington. The amount actually available is but $100,000, with the understanding that the entire cost of the work shall not exceed $400,000. Mr. Hunt of New York, the architect appointed by the secretary of the navy, has been in Washington examining the site, and consulting with the superintendent of the observatory and Professor Hall, and it is understood that he is now at work upon the detailed drawings. Plans were prepared some seven years ago under the direction of Admiral John Rodgers, then superintendent of the observatory, but they will be very largely modified in order to isolate more effectively the observing-rooms from the main building. Ensign Winterhalter of the U. S. naval observatory has sailed for Paris to represent the observatory at the

conference called by Admiral Mouchez, director of the Paris observatory, for the purpose of forming a plan of co-operation in photographing the whole sky. The proposition is to enlist ten or twelve observatories in the undertaking, and to obtain instruments of uniform power, so that their work may be homogeneous. If the suggestion that each plate shall be four degrees square is adopted, about 11,000 plates will be required; and, with an average of 100 plates per year from eleven observatories, it will take ten years to complete the map. It is understood that Dr. Peters of Clinton, and Mr. Rutherfurd of New York, will also attend the conference.

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A VERY VALUABLE CONTRIBUTION by T. Mitchell Prudden, M.D., on bacteria in ice, and their relations to disease, with special reference to the ice-supply of New York City, appears in the *Medical record* of March 26. In a series of thirty-two biological analyses of the Croton water, as it is delivered in the city, Dr. Prudden found the lowest number of living bacteria to be 57 to the cubic centimetre; the highest, 1,950; while the average was 243. While it was at one time thought that the presence of a considerable number of living bacteria in a water was evidence of its being unfit for drinking-purposes, we have now learned that this view must be greatly modified. Bacteria are almost everywhere present, in soil, air, etc., and by far the larger proportion are, so far as we know, perfectly harmless. Their *rôle* in nature is to tear down organized bodies into their simpler constituents, a small part of these being used for their own nutrition and growth, while the larger part is given up to other organisms for their life-purposes. It still remains true, however, that a certain number of species, which can live in water as well as elsewhere, can and do produce deadly diseases, and are responsible for some of the most frightful epidemics.

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Dr. Prudden made a series of experiments to test the effect of freezing on the bacteria. His method was as follows: a large number of test-tubes were plugged at the mouth with cotton, and sterilized. Into these tubes was put sterilized water mixed with a small quantity of a pure culture of some well-defined species of bacteria, the number of bacteria in one cubic centimetre of water having been previously determined. The tubes were then exposed to a temperature of from 14° to 30° F., the water becoming solid in a short time. Six different species of bacteria were thus experimented with: 1°. Bacillus prodigiosus; 2°. A short bacillus frequently found in the Hudson River water, and occasionally in the ice, apparently identical with the Proteus vulgaris of Hauser; 3°. A slender bacillus very common in Croton water; 4°. Staphylococcus pyogenes aureus, derived from a case of pyaemia; 5°. A short bacillus very common in ice all about New York, which may be designated the 'fluorescent bacillus,' from its appearance in gelatine; 6°. The bacillus of typhoid-fever. In the case of the Bacillus prodigiosus, there were 6,300 bacteria in a cubic centimetre of water before freezing; after being frozen 4 days, 2,970; after 37 days, 22; and none after 51 days. Of the Staphylococcus pyogenes aureus, there were a countless number before freezing; after 18 days of freezing, 224,598; after 54 days, 34,320; and after 66 days, 49,280: of the typhoid-fever bacillus, innumerable before freezing, 1,019,403 after being frozen 11 days, 336,457 after 27 days, 89,796 after 42 days, and 7,348 after 103 days. These experiments were repeated with practically the same results, so that it may be accepted as abundantly proven, that, after prolonged freezing, a considerable number of the typhoid bacilla remain alive.

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## *WILLIAM BABCOCK HAZEN.*

THE sudden death of Brig.-Gen. William B. Hazen, chief signal officer of the U. S. army, which occurred on Sunday, Jan. 16, 1887, deprived the country of one of its most distinguished officers, and the signal corps of a chief who took a broad view of its duties and relations to the world of business and science.

Gen. William B. Hazen was the great-grandson of Thomas Hazen, who was born in 1719, and who was himself a great-grandson of Edward Hazen, who emigrated from England before 1649, and settled at Rowley, Mass., where he died in 1683.

The descendants of Edward Hazen include many names eminent in business, theology, and war. Energy, industry, and strong convictions characterize the members of the family on all sides.

General Hazen was born at West Hartford, Vt., Sept. 27, 1830. While he was yet a child, his parents removed to Hiram, Portage county, O. In 1851 he was appointed from Ohio as a cadet to the U. S. military academy at West Point, from which he graduated July 1, 1855. He was assigned to the 8th U. S. infantry, and spent the next five

years in frontier service, more especially against the Indians in California, Oregon, and Texas, in which service he displayed an energy and bravery that have been characteristic of his life. His record during these years embraces constant fights and pursuits. He was twice severely wounded, and by virtue of his wounds, he was, in January, 1860, by the surgeon's order, granted a leave of absence as being unfit for duty. In consequence of this, he was at the north, while his regiment was in Texas, at the breaking out of the rebellion. The regiment having been captured, and its officers released on parole, he alone was unembarrassed by the parole, and was able to offer his services to the Union army. He was at once assigned as temporary instructor at West Point. In May, 1861, he became captain in the 8th infantry of the regular army, and in October was made colonel of the 41st regiment of Ohio infantry, in the volunteer army. During the war, he distinguished himself on many occasions, and his commission as major-general was granted him Dec. 13, 1864, for 'specific distinguished services;' i.e., "for long and continued services of the highest character, and for special gallantry and service at Fort McAllister." This placed him fifth in a list of twenty-four officers who had received commissions for distinguished services.

He continued serving on the frontier territories, north and west, and was especially active in Indian affairs, until 1870, in which year he was allowed leave of absence to visit the seat of war in Europe. The results of his observations and studies during his six-months' absence are embraced in a volume entitled 'The school and the army in Germany and France, with a diary of siege life at Versailles' (New York, 1872). This volume contains an interesting sketch of Bismarck, and Bismarck's own account of the state of affairs in Europe. It contains especially a fair criticism of the relative excellences of the German and French systems, both civil and military. In a special chapter on that subject, he incidentally brought out more prominently some weak points in our own military organization. It would seem that the courage displayed so brilliantly on the battle-field frequently nerved him to utter not only these but other fearless criticisms of things that were palpably wrong, and some of which have since been corrected.

He was married Feb. 15, 1871, to Millie, daughter of the Hon. Washington McLean of Cincinnati, who, with one son, survives him.

On his return from Europe in 1871, he returned to duty in the Indian Territory, and was with his regiment in Kansas and Dakota, except for a short absence, until Dec. 15, 1880, when he was by President Hayes appointed brigadier-general and chief signal officer, and has since then been stationed at Washington. The absence just referred to was occasioned by his again visiting Europe as military attaché to the U. S. legation at Vienna, for the purpose of studying the operations of European armies during the Turco-Russian war. He was absent on this service from December, 1876, to June, 1877, and the results of his observations were published subsequently in a highly interesting popular volume.

The general account of his activity during the war of the rebellion was published by him in his 'Narrative of military service' (Boston, 1885).

His letters and pamphlets on the 'Bad Lands' show that for many years General Hazen had been studying the relations of meteorology and agriculture. Upon his appointment as chief signal officer, he became indefatigable in his efforts to improve the military and departmental relations of the signal service, its scientific character, its practical usefulness to farmers and herders, and its popular influence. His labors in Washington stirred up most virulent opponents, — first, when it became necessary for him to expose and prosecute the corruption of Captain Howgate; again, when it became necessary, in self-defence, to expose the true reasons of the failure of the war department to properly support and succor the signal-service expedition to Fort Conger; and again, when he had occasion to defend the advantages of the military character of the combined signal-service and weather-bureau organization against those who would take it from the army without making a proper provision for its work in any other department. The records of his successful defence against attacks prompted by implacable hate, official stubbornness, and personal ignorance, are to be found in the Proceedings of courts-martial, courts of inquiry, committee of congress on expenditure, and especially in the 'Testimony before the joint commission to consider the present organization of the signal service,' etc., which last voluminous report, with testimony, was printed in June, 1886.

General Hazen's interest in meteorology, as before said, properly dates back earlier than 1873, at which time he prepared a letter on 'Our barren lands, or the interior of the United States west of the 100th meridian and east of the Sierra Nevadas.' This was published in the New York *Tribune*, Feb. 27, 1874, and led to a discussion in that paper, and in the Minneapolis *Tribune*, between himself and Gen. A. A. Custer, which is summarized in a pamphlet of the above title published by Robert Clarke & Co. of Cincinnati, in 1875. The motive of General Hazen evidently was the protection of

investors and settlers against the too glowing accounts, which amounted to virtual misrepresentation, on the part of the employees of the Northern Pacific railroad. His compilation of climatological data, and his statement of personal experience based on long residence in that region, largely contributed to prevent blind emigration into an inhospitable country, while they doubtless also contributed to direct attention to the really valuable portions of our north-west territory, so that the permanent development of that portion of the United States has been furthered by his action. It was, however, at the time, on his part a very characteristic, outspoken exposition of what seemed to him a fraud and imposition, perpetrated by unscrupulous financiers upon foreign immigrants and over-confiding settlers and investors.

During his connection with the signal office, General Hazen frequently took occasion to show his appreciation of the fact that the weather-predictions were essentially not a matter of mere military routine, but that in all departments the office had need of the work of specially trained experts; that it was a mistake to shut one's eyes to the fact that in a matter of applied science, like this, some of those whom the scientific world recognizes as meteorologists and physicists must be employed, and be required to keep the chief fully informed of the progress of science. Perhaps this is best exemplified by a quotation from his letter of March 24, 1886, addressed to a committee of the house, on expenditures of the war department: "At the beginning of the work of the signal service, the duty of giving notice of the approach and force of storms and floods, for the benefit of commerce and agriculture throughout the United States, implied that the notices should be correct, reliable, and timely, as none others could possibly be of benefit; it was therefore absolutely necessary to provide for the careful study of the atmosphere. On my accession, I found every evidence from popular criticism that still further progress in weather-predictions was expected. I therefore emphasized especially the necessity of the study of the instruments and methods of observing, and the investigation of the laws of the changes going on in the atmosphere. . . . It is evident by these successive steps, that, in addition to knowledge gained for current work, the office is powerfully contributing towards the establishment of a deductive science of meteorology, which will eventually give us a solid, rational basis for predictions, thereby improving on the empirical rules by which predictions have generally been made hitherto." And he adds that he was led more especially to assist in the researches on the sun's heat by reason of the encouragement given him by the late President Garfield, whose "last words to me were, 'Give both hands of fellowship and aid to scientific men.'"

As a further illustration of General Hazen's appreciation of the scientific needs of the office, must be noted his appointment of Prof. William Ferrel as meteorologist, and of Prof. T. C. Mendenhall as electrician: to the latter, all matters relating to standards, instruments, and instrumental research were also committed. Nor did he stop here, but, by appointing several younger men to positions as junior professors, he largely increased the amount of study and research that the office was able to perform; and by publishing a series of professional papers and smaller notes, he took the final steps necessary to stimulate every man to do his best.

Laboring in this same direction, he sought to elevate the intelligence and scientific training of the signal corps proper, by enlisting college graduates as far as possible, by extending the course of instruction for observers, and by establishing a course of higher instruction for commissioned officers.

In still another direction General Hazen showed his affiliation with scientific interests; namely, by his desire to conform as thoroughly as possible to the recommendations of the international meteorological conferences. These recommendations, as soon as received in the printed minutes of the conferences, were, by General Hazen's orders, carefully examined, and instructions at once prepared calculated to introduce methods of observation and publication in conformity with the recommendations of the leading meteorologists of the world.

Among the items specially noteworthy, wherein General Hazen developed new paths of activity for this service, may be mentioned the study of local thunder-storms and tornadoes, which were assigned respectively to Prof. H. A. Hazen and Lieut. J. P. Finley so far as a collection of general statistics is concerned, and to Professor Mendenhall so far as concerns the electrical phenomena proper. The study of atmospheric electricity was especially authorized in 1884, by an order of the secretary of war, transmitting the resolutions of the international electrical conference held in Paris the preceding year. After full consultations with numerous electricians throughout the country, General Hazen decided that a daily map of electric potential, showing lines of equipotential, similar to the isobarometric lines, offered hopeful prospect of leading eventually to a method of predicting the formation and motion of thunder-storms and tornadoes. But the methods of observation and the apparatus

needed first to be determined upon, after careful experimental work. This whole matter was therefore, in 1885, committed to the hands of Professor Mendenhall.

Perhaps the most important item in internal administration, so far as it affects the permanent scientific value of the office-work, was the effort, heartily furthered by General Hazen, to improve the accuracy and international comparability of our instrumental equipment. The standards of the International bureau of weights and measures were recognized by him as being the proper legal standards for this office, and every effort was made to determine the corrections needed to reduce the past as well as the current meteorological observations of the signal service to agree therewith.

Perhaps the generous breadth of General Hazen's views, the absence of injurious jealousies, and his confidence in the principle that the weather-bureau would be strengthened by the widest diffusion of an intelligent appreciation of meteorology, are in nothing more clearly shown than in the earnestness with which he stimulated the formation of state weather-services, and encouraged the study of meteorology in every school and college. He was painfully impressed by the disastrous influence upon individuals and business of the wide-spread and utterly absurd predictions of the storms and weather of the 9th of March, 1884, which emanated from Mr. Vennor, and were distributed broadcast through the country. He saw clearly that all this harm could be prevented only by increasing the intelligence of the people in scientific matters, and heartily indorsed every effort to diffuse a more correct idea as to what constituted legitimate meteorology.

Although his duties demanded the maintenance of a great central office at Washington, yet General Hazen realized that centralization could easily be carried too far in scientific matters, and would thus react injuriously upon the work of his office. He was desirous of rapid progress in all directions, and, to secure this, welcomed every prospect of co-operation with other institutions as well as with individuals. One of his first acts was the request for co-operation on the part of the National academy of sciences. He improved the opportunity to help Professor Langley in the determination of the absorbing-power of the atmosphere; he accepted Professor King's offer to carry observers on his balloon voyages; he heartily furthered Lieutenant Greely's efforts to maintain an international polar station, and joined with the coast survey in establishing a similar station, under Lieutenant Ray, at the northern point of Alaska; he co-operated with the bureau of navigation in securing weather-reports from the ocean; he powerfully assisted the metrological society in its labors for the reformation of our complicated system of local times, the result of which was the adoption by the country of the present simple system of standard meridians one hour apart.

Equally successful was he in his efforts to co-operate in various methods of disseminating and utilizing the knowledge obtained by the weather-bureau for the benefit of the business interests of the country. With the telegraph companies he published the daily telegraph bulletin. Through the railroad companies he displayed the railroad train signals, visible to every farmer along the railroads. With local boards of trade and other business interests he elaborated our system of flood-warnings in the river-valleys.

General Hazen was especially clear in his views as to the importance of giving personal credit to each man for his own personal work. Routine work was credited to the assistants in charge, and not to the impersonal office. Having assigned a special work to the best man available, he took pains to give him the credit, and make him personally responsible for its success, thus securing more enthusiasm in the work.

This notice of a few prominent features in the intense activity of General Hazen's life seems eulogistic rather than historical; but, to the contrary, the fact is, that military life rarely offers a position that requires the promotion of any special science, and still more rarely do official or military circles present an officer who so thoroughly desired, as far as allowable, to relax stringent military law, and liberally interpret cumbersome official regulations, so that scientific men might successfully promote their special work.

CLEVELAND ABBE.

## *ETHNOLOGICAL NOTES.*

THE Proceedings of the U. S. national museum, for 1886, contain a paper by George H. Boehmer on Norsk naval architecture. He compares the modern Northland boat, which is in use along the coast of Norway, round the North Cape to the frontier of Russia, with the ancient Norsk boat. In this boat he recognizes the oldest forms known. These are known from the rock sculptures discovered in Sweden and Norway, which are supposed to have been made from five to eight hundred years before the Christian era; from boat-shaped stone burial-groups, supposed to have been erected during the transition time from the bronze period to the iron age, in Scandinavia; and from boat-remains. The boat is long, narrow, and low, with stem and stern posts alike, both being curved and high. The rowlocks of these boats bear an oblique pro-

longation on one end, and are furnished with a loop through which the oar is passed. They have a single mast amidships, and a single sail. In the rock carvings similar boats are represented all along the coasts of the Baltic, as far east as the south-east bank of Onega Lake, and on the coast of Norway. In the boat-shaped stone groups the high stem and stern posts are indicated by large bowlders; the rowlocks, by excavations in the stones. The boat-relics resemble the modern boat even in details, and show how little change has been made in northern naval architecture since olden times.

Donald A. Cameron, English consul for eastern Soudan, is studying the ethnology of the district of Suakin. The preliminary result of his researches is that the Beja (Bisharin), which is the general name applied to all tribes of that country speaking Tobedawiet, are the aborigines, who gradually adopted Islam through contact with the coast or with Egypt after they had absorbed a number of Arabs from Yemen who had invaded their country (*Journ. anthrop. inst.*, Feb. 1887).

The Bulletin of the Italian geographical society, for February, contains the catalogue of an ethnological collection made by General Gené in the Italian possessions on the Red Sea. It consists of implements, clothing, ornaments, and weapons belonging to the Beja, and some Somali and Abyssinian objects. The explanation of the well-known implements is very full, and contains much valuable information.

Ph. Paulitschke has published the results of his studies on the Somali, Galla, and Harrari ('Beiträge zur Ethnographie und Anthropologie der Somâl, Galla, und Harari,' Leipzig, 1886). He gives a full description of the ethnological character of these peoples, and several anthropological measurements. It is impossible to point out the numerous new observations contained in this book, and we confine ourselves to stating the conclusions at which the author arrives regarding the history of these peoples. Originally the country was inhabited by negroes who had been driven from their old seats by Hamitic invaders, who came from the north. Later on, an Arabic invasion took place, which began in the sixth century and lasted until the sixteenth. The invaders and Hamites intermarried, and thus formed the Somali and Dankali, which latter contain a larger proportion of Semites. These nations attacked the Gallas, who were driven from the shore to the country they now occupy. A map which accompanies the book shows the distribution of the tribes.

R. N. Cust has presented to the Anthropological institute of England a collection of symbolic letters such as are used by the Jebu in West Africa. They are figured in the Journal of the anthropological institute (February, 1887), and full explanations are given. There are many specimens of such messages in the ethnological collections; but few of them have the explanations, which alone make them valuable. It would be very desirable to have examples of symbolic messages collected among all peoples, and their study pursued in connection with that of picture-writing and sign-language.

The Journal of the anthropological institute (February, 1887) contains an interesting paper by A. W. Howitt, on songs and song-makers of some Australian tribes, and several specimens of songs noted down by G. W. Torrance. The poets of the tribes are held in great esteem. Their names are known to the neighboring peoples, and their songs are carried from tribe to tribe, even beyond the limits of the language in which they are composed. The natives believe that the songs are obtained by the bards from the spirits of the deceased, usually their relatives, during sleep, in dreams; but Howitt gives some instances of songs which are descriptive of events, and, as the poets declare, composed under the influence of some natural cause. Torrance gives three tunes, which he has divided into bars, according to the style of our music. This, however, is not correct, as the irregular accent does not allow their being arranged in this way. Fortunately the study of aboriginal poetry and music is being taken up now by several students. We call to mind Brinton's, Stumpf's, and Baker's researches. But an energetic pursuit is very desirable, as the native literature, which is handed down by tradition alone, is being rapidly lost everywhere.

Dr. H. Rink announces the death of Samuel Kleinschmidt, which occurred at Godhaab, Greenland, Feb. 9, 1886. Kleinschmidt, who was born in Greenland, is distinguished by his eminent knowledge of the Eskimo language. The results of his studies, which form the foundation of our knowledge of that language, are contained in his dictionary and grammar of the Eskimo language. Of late he took an active part in studying the meteorology of Greenland.

W. Sievers gives a brief sketch of the Arhuaco Indians, who live in the Sierra Nevada de Santa Marta, in the *Zeitschrift der Gesellschaft für Erdkunde* (vol. xxi. p. 387). The author travelled in Columbia in 1886, and visited the four villages of these Indians. The natives living on the northern declivity of the Sierra have preserved their old customs to a higher degree than the rest. Sievers describes their round, low huts and their scanty household goods, which consist of a pot, a bed, a few wooden stools, and a number of pouches

made of the fibres of the agave. The men and the women live in separate houses, and are never allowed to be in one room. The man takes his meals on a stone, between his house and that of his wife. They eat little meat, but live principally on vegetables, which are grown in small gardens. Though many of them have become Christians, they still adhere to their old religious feasts and dances, which they perform at the celebration of the saints of their villages. Each tribe has its peculiar dances, which are accompanied by two kinds of flutes, marimbas, and rattles. Sievers states that they believe a woman, by the name of Inhimpitu, to have been the mother of the ancestors of their gentes. These ancestors created the earth, the houses, the sun, — which formerly was buried in the ground, — the moon, and the stars. Takina is their principal place of worship. Here rows of stones are found, with interplaced granite bowlders. A wizard watches this place, which no Spaniard is allowed to visit. In a small temple, and two huts which stand near by, various utensils used in the worship are kept, — drums, flutes, masks, rattles, and tripods made of wood. Under one of the large bowlders is the grave of a wizard, to whom they give offerings. The wizards cause disease by throwing spiders, scorpions, or lizards into the bodies of their enemies, and cure the sick by extricating the cause of the disease. They are not allowed to eat any salt. During the great festivals, which are celebrated in January, the Indians must abstain from the meat of domesticated animals. At Masinga, on the upper Manzanares, there are large ruins of a temple, and long, remarkably straight roads leading to it. Ancient roads are found in many parts of the Sierra, and are frequently used for the construction of modern roads. A grammar of the language of the Arhuaco, the Köggaba, has been published by R. Caledòn ('Gramatica de la lengua Köggaba,' Paris, 1886).

E. T. Hamy believes that the sinuous line which is found on one of the monuments of Copan, in Honduras, is identical with the Chinese Taï-Ki (*Journ. anthrop. inst.*, February, 1887). Though these figures closely resemble one another, both consisting of two semicircles lying in opposite directions and touching each other, this is no proof of a common origin and identical meaning. The Chinese symbol represents two opposite principles, — the active and passive spirits, the masculine and feminine, light and darkness. The conclusion drawn from the similarity of ornaments occurring in widely separated regions, upon the identity of their symbolic meaning or their common origin, is fallacious.

Chaffanjon, who is exploring the upper Orinoco, found at Ature, in a cave of the Cerro de los muertos, the burial-place of the Piaroas. The corpses and those objects which had been most valuable to the deceased are put into a kind of basket, or into a cylinder made of twigs arranged in parallel lines round the body and tied together. Most of them are covered with stones to keep them from being disturbed. In the cave of Arvina, in Cerro Saloajito, Chaffanjon found vases differing in style from those which Dr. Creyaux found at Maipure. On the rocks of Cerro Purtado he found large sculptures. From his observations on these inscriptions he concludes that extraordinary means and a long time were required for making them. These petroglyphs seem to be of frequent occurrence in those districts. Recently A. Jahn found several in the Loma de Maya, west of Caracas. One of them is figured in the *Zeitschrift für Ethnologie* (1886, p. 371). The commission for determining the boundary between Brazil and Venezuela found others on the left bank of the Guainia, between Solano and Buena Vista. Similar rock inscriptions are found below Maroa, near San Gabriel, Itapinima, and at other places, and, according to W. Sievers, on the upper Manzanares. Chaffanjon studied the dialects of the country he traversed, and collected extensive vocabularies of the Baniba, Piaroa, Guahiro, Puinabe, Piapoco, and some of their grammatical elements. All of these belong to the same stock.

## *GEOGRAPHICAL NOTES.*

### *Europe.*

The government of Roumenia plans a triangulation of that country. As the basis of the present maps is founded on the reconnaissance made by the Austrian army during the occupation of Roumenia in 1855, a thorough survey is very desirable for completing our knowledge of the topography of Europe.

### *Asia.*

The following notes on the work of the Indian survey are taken from *Petermann's Mittheilungen*. Besides the regular reports, the annual report for 1884 and 1885 contains the results of expeditions made in the countries adjoining India. Col. R. G. Woodthorpe visited the western head waters of the Irawadi, — the Nam Kiu. He followed the Dihing, a tributary of the Brahmaputra, to its sources, crossed the Phungan Mountains at the Chaukan Pass, and reached, south of the farthest point reached by Wilcox in 1826, the Nam Lung, which he descended to its confluence with the

Nam Kiu. After a visit to Padao, the capital of the Bor Kamti, he retraced his journey, following the Turong, which is the principal source of the Kyendwen. The map showing the results of this journey is contained in the January number of the Proceedings of the Royal geographical society. The amount of rain falling in the mountains crossed by Woodthorpe explains the enormous quantity of water carried by the Irawadi. Col. H. C. B. Tanner tried to enter Tibet, but was prevented from carrying out his intention by the Tibetan boundary post at Purang Jong. He explored some parts of Bhutan, and had the foot of the Kinchinjinga surveyed. The Indian survey plans the publication of maps showing the countries adjoining India. These 'Trans-frontier of India sheets,' which will be on a scale of an inch to eight miles (1 : 506,880), will consist of four parts; 'North-western trans-frontier,' including Beluchistan, Afghanistan, Turanian states; 'Northern trans-frontier,' including East Turkestan and western Tibet; 'North-eastern trans-frontier,' including eastern Tibet as far as Yun-Nan; and 'South-eastern trans-frontier,' including Burma and western Siam. These maps will embrace the Indian surveys, the results of which have not been made public, on account of political reasons, and a critical review of the whole available material. It is proposed to extend the work to western Persia, Asia Minor, and Arabia.

### *Africa.*

G. A. Krause, whose arrival at Mosi was announced a few weeks since, has proceeded by the way of Duensa to Safaram on the upper Niger. He intends to follow the river to Kabara, the port of Timbuktu. As Krause travels undisguised, as a Christian, he expects to find some difficulties at Massina on account of the fanaticism of the Fulbe.

Upon his return to Berlin, a reception was tendered to Dr. Junker by the geographical and anthropological societies. Junker gave a brief sketch of his six years' travels in Africa. In January, 1881, he went from Suakin to Khartum, whence he ascended the Nile by steamer to Meshera. From there he travelled to Ndorumo, where he established a station in May, 1881. He described his explorations south and west of Ndorumo, in the unknown district drained by the Welle and its tributaries. He made large ethnological collections among the Mang-Battu (Schweinfurth's 'Mombuttu'), which he sent by his companion Bohndorf to the Bahr-el-Ghazal. Unfortunately these were lost. The progress of the Mahdi prevented Junker's return, so he went to Ladò to Emin Bey, expecting to meet a steamer going north. The Emir Karam had sent them notice of the capture of Lupton Pasha, governor of the province of Bahr-el-Ghazal, and in January, 1885, they learned of the loss of Khartum. Later on, the Mahdi attacked Emin Bey, and took Amadi, which is only five days distant from Ladò. For some unknown reasons, however, he retreated. Dr. Junker then returned to Europe, starting from Wadelai.

### *America.*

The proposed field-work of the Canadian geological survey for the coming season includes an extensive topographical and geological survey of the upper Yukon, of which Mr. George M. Dawson will be in charge. It is proposed that one branch of the expedition shall proceed through the valley of the Stakeen River, cross the summit of the Rocky Mountains, and ascend the Liard River. Here they will pass the watershed between the Yukon and Mackenzie, and descend Pelly River. At Fort Selkirk, where the Pelly River joins the Yukon, they will meet the other branch of the expedition, which will proceed from Chitlkat Inlet (Lynn Fiord) to the head waters of the Yukon. From Fort Selkirk, short expeditions will be made up the branches of the Yukon, on both sides, and down the main stream. W. Ogilvy, who will be in charge of this branch of the expedition, will remain in the district during the winter of 1887, but Dr. Dawson will return next fall by the route of Lynn Fiord. We are indebted to Dawson for his explorations in Vancouver Island, Queen Charlotte Islands, and the Rocky Mountains of British Columbia; and we may expect that the proposed exploration, carried on under his skilful management, will be successful, and glean valuable results in the vast unknown north-western territories. It must be regretted that a survey of the boundary between Canada and the possessions of the United States cannot be undertaken at the same time, as both expeditions would help and further one another.

The French hydrographical office has published a map of the Cape Horn Archipelago and the Beagle Channel, from the surveys made by the steamer La Romanche during the years 1882 and 1883, when a polar station, according to the international plan, was established in Orange Bay. The map contains many important corrections of the coast-line.

The Instituto geografico Argentino has issued the first sheets of the 'Atlas de la République Argentina,' edited by Dr. A. Seelstrang. The basis of the atlas are the surveys of the land-office, railroads, and boundary commissions. It will consist of thirty sheets, each province being represented on a scale of 1 : 1,000,000.

*Polynesia.*

The eruption of Mauna Loa has almost entirely ceased, although steam is still issuing from fissures along the mountain-side. The activity in the crater of Kilauea, more particularly in Halema'u-ma'u (*vide* map in *Science*, ix. 181), is constantly increasing.

*Polar regions.*

The well-known Scotch whaler David Gray of Peterhead, who tried to find a new whaling-ground in the sea surrounding Franz-Josef Land, has failed to reach those islands, as the pack-ice extended far south, and was so closely packed that he was unable to enter it.

Mr. Alexander McArthur has returned from his 'trip to the north pole,' after having reached York Factory, and has given up his plans of proceeding by the Hudson Bay route.

## NOTES AND NEWS.

THE Journal of the science college of the Imperial university of Japan, the first part of which has just made its appearance, may be regarded as a continuation of the scientific memoirs which have been from time to time published by the Tōkyō university. This journal is intended to be the journal through which the world at large may receive Japan's own contributions to the progress of science. One unique feature which will be apparent at once has regard to the language or languages in which the various papers are to be presented. Each contribution must be written in one of the three languages, English, French, or German, the choice being left entirely to the author. The necessity for this tri-lingual character springs, of course, from the very peculiar but well-known condition under which science has been cultivated in Japan and by the Japanese. The appearance of this journal is a strong commentary on the advance in culture in Japan, which, from being a country depending on the culture of foreign parts, is now beginning to return the debt.

— Our readers who are interested in astronomy will find an excellent guide for first explorations of the constellations in an illustrated article by Mr. G. P. Serviss ('Astronomy with an opera-glass — the stars of spring'), contributed to the *Popular science monthly* for April.

— A state board of health has just been organized in Vermont, making twenty-nine states which now have state boards.

— The *Medical record* quotes Dr. Mackenzie as being of the opinion that American catarrhs are largely due to the dust, and says that it is not unreasonable to believe that the tremendous clouds of unsterilized earth which are driven into the faces of our city's population during this season have something to do with the excess of coughs and colds and the high mortality-rate during this period, which in some years is exceeded only in the hot months of summer.

— An experimental passenger-train, lighted throughout by electricity, and heated by steam from the engine, now runs between New York City and Boston. Each car is illuminated by eighteen 16-candle glow-lamps, the current being derived from storage-batteries hung beneath the floor-timbers, charged for ten hours by dynamos. Both light and heat are said to be ample; and danger from fire, in case of accident to the train, is much lessened, if not almost wholly done away with.

— Messrs. Estes & Lauriat, Boston, announce for early publication, 'Key to North American birds,' third revised edition, by Elliott Coues; also 'Key to North American birds,' sportsman's and tourist's edition.

— Among recent numbers of the Van Nostrand science series, we note the following: 'Petroleum, its production and use,' by Boverton Redwood, a reprint from the Journal of the Society of arts, London, with the omission of such portions as would seem to be of little or no interest to American readers; 'Leveling, barometric, trigonometric and spirit,' by Ira O. Baker, prepared originally as a part of the author's lectures on geodesy, given in the University of Illinois; 'Analysis of rotary motion, as applied to the gyroscope,' by J. G. Barnard, a reprint of the analytical exposition of the motions of the gyroscope, written by General Barnard in 1858 for the *Journal of education*; 'Beams and girders, practical formulas for their resistance,' by P. H. Philbrick, which aims to deduce general formulas for the resistance of beams and girders, applicable to all cases, and to set forth truly practical formulas so far as seemingly required in the use of existing forms and sections; 'Compressed gun-cotton for military use,' by John P. Wisser, a translation of the work of Lieutenant von Förster, with additions giving an outline of the present process of manufacture and a summary of the properties of the best form now produced.

— The fish commission will send the steamer Albatross to the Pacific coast next fall, to remain several years, and will make a thorough investigation of all matters relating to food-fishes. The cod, halibut, and other food-fishes are caught in the Pacific; but little is known of their distribution, and the fisheries have not been developed. The Albatross will also make investigations in the Gulf

of California. The commission has deposited during the last few years a large supply of young shad in the Colorado River, and the Albatross will visit the Gulf of California partly with the view of ascertaining the results of this work. The Thetis, which will cruise in Alaskan waters, will also make investigations, and the results of the work in arctic waters will be important in connection with the investigations of the Albatross.

— Capt. C. E. Dutton, chief of the bureau of volcanic geology of the geological survey, will read a paper at the next meeting of the National academy of sciences, which occurs the third week in April, embodying the results of the study of an immense mass of data upon the Charleston earthquake. The recorded rate of motion of earthquakes of history varies from three thousand to nine hundred metres per second. The data upon the Charleston disturbance prove conclusively that its earth-waves travelled between four thousand and five thousand metres a second, while French journals containing observations upon the Riviera shock give rates almost as high.

— It is believed that the department of agriculture's new departure in setting up machinery in Washington for winding the silk from cocoons will result in considerable extension of the silk-growing industry in this country. Great interest is manifested in the experiments, and the demands for copies of the bulletin on silkworm culture has made it necessary to issue seven or eight editions. Officials of the department say that the requests for silkworm eggs greatly exceed those received in any previous year since the department began their distribution. As a consequence, it is expected that large quantities of American-grown silk will be placed on the market this year.

— Commissioner of Agriculture Colman has returned to Washington from a recent trip to Louisiana to investigate the field for experiments in cane-sugar making by the diffusion process. He speaks highly of the mammoth plantation of Governor Warmouth, which has been selected for the work, and says, that, if the experiments in Louisiana are successful, the planters will be enabled to compete successfully with the beet-sugar interests beyond a doubt. Cane which would ordinarily yield eighty pounds to the ton will yield a hundred and forty pounds under the new process.

— A curious instance of lead-poisoning is reported in the *Medical news* by Dr. Bidwell of Vineland, N.J. The patient had been distilling domestic wine, using a coil of lead pipe for the worm of the still. Some of the wine had undergone acetic fermentation; and the acetic acid, being less volatile than the alcohol, had distilled only at the last of the process, when, trickling through the lead pipe, it had taken up and carried with it the poison as sugar-of-lead. The patient had observed a slightly sweetish taste in the brandy which came over last. Some similar cases of lead-poisoning have recently occurred in England, due to the same cause; the acids of home-made wines having acted upon the glaze of the earthenware vessels in which fermentation has taken place.

— The assumed fact that plumbers escape disease and infection from the inhalation of sewer-air is often referred to as indicating the harmlessness of this air or gas. Were all the facts known, this view would undoubtedly be much modified. A recent occurrence in England would seem to prove that men who follow this trade are not so exempt as is generally supposed. An inquest was held during the past month in Liverpool on the body of a plumber's apprentice who had been engaged during the previous week in repairing pipes which connected with a sewer. Quantities of gas came through these pipes, and at the time the young man complained of pain and sickness: in forty hours he died. The medical evidence was to the effect that death was due to the inhalation of sewer-air, and the jury rendered a verdict to that effect.

— Dr. Goto, of the Kakaako leper hospital in Japan, is said to be able to cure leprosy. Patients are bathed daily in warm water containing an infusion of Hichiyon bark, Aesculus turbinata, and sulphur. They are fed on a generous diet, and take internally the bark of the Hoang-nan tree, besides iron, quinine, and other well-known remedies. He reports that five of his patients are 'almost cured,' nineteen are improving, and seventeen are relieved.

— From the *British medical journal* we extract the following in reference to the duration of infectiousness in the diseases named: measles, from the second day, for exactly three weeks; small-pox, from the first day, under one month, probably three weeks; scarlet-fever, at about the fourth day, for six or seven weeks; mumps, under three weeks; diphtheria, under three weeks. While these may be reliable averages, we doubt very much whether any one can fix the exact period during which any of these diseases may be communicated, as is here done with measles. Some excellent authorities believe, that, even before some of these diseases make their presence known, persons exposed may contract them.

— Professor Dennis of New York recently made a number of interesting observations to test the

purity of the ocean-air while crossing the Atlantic. He had previously prepared capsules of sterilized gelatine. One, which was exposed in a state-room on the main deck of the steamer, developed five hundred points of infection in eighteen hours; one exposed in the cabin on the main deck developed only five or six points in ten days; a third, hung over the bow of the ship for ten days, remained uncontaminated.

— A parrot is reported to have died of diphtheria contracted from children sick with that disease in the same house.

— A new and complete edition of the writings of Galileo, in twenty volumes, is to be published at Florence under the authorization of the Italian minister of public instruction, who has nominated a committee of scholars to edit the work.

— We have received a communication from Professor MacGregor in reply to Dr. Hall's last letter on inertia-force, but we consider the subject to have been sufficiently discussed for the present.

## LETTERS TO THE EDITOR.

***The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Elementary instruction in zoölogy.

I WAS much interested in the letters of 'L. H.' and Mr. Shufeldt in regard to the teaching of zoölogy, and I am inclined to agree, almost without qualification, with the latter.

It is unnecessary to make any distinction between a high school and a college course; for at the present time they are practically identical, inasmuch as few college students have had any zoölogical training in their preparatory course. Is, then, the course indicated by 'L. H.' a wise course for the general student? My experience leads me to believe that he is almost as far from the *best* course as the old style of teachers whose work was undeniably superficial.

The theory of studying one animal thoroughly, then taking up nearly related forms, and gradually extending the study to the whole animal kingdom, is very plausible; but has 'L. H.' tried it with an ordinary college class, and in the time allotted to zoölogy in the ordinary college course? He indicates a course that would require several years of continuous work, while most colleges give from one to three terms, and allow for only a limited amount of laboratory work.

Now, while zoölogy is a science worthy of being taught *for itself* and for the discipline it affords, it has a bearing on other sciences, and this second element must not be lost sight of. For example: to understand geology, the student must know the principles of classification of animals; but the method of 'L. H.' would never bring the average student to knowledge of classification. He would know about crustaceans perhaps, but might in reality know very little of zoölogy.

I find I get the best results by following a method which is essentially like that outlined by Mr. Shufeldt. First my students dissect, in a somewhat superficial manner of course, a series of types. For this work I find that even a manual like Colton's tells too much: for I wish to have students, first of all, learn to use their own eyes, and not simply to verify some one else's description. For this stage of the study the less of text-book and the fewer works of reference, the better. In order that material may not be wasted, I furnish my students a little pamphlet of elementary instruction, which tells them what to do, but not what they will find.

This work forms a basis for teaching classification, which I do largely by lectures, or rather talks.

This elementary work gives the student a fair general idea of the animal kingdom. That his knowledge is superficial, I acknowledge, but I consider it none the less valuable. Now the student is prepared to make a thorough study of some higher animal. We use the cat, and from the cat teach the comparative anatomy of vertebrates. More advanced students take up histology and embryology.

I do not think that in this course we have reached the ideal; we may make great changes in it: but it seems to us the best according to our present knowledge.

I am inclined to think that the compound microscope is used too freely with elementary classes; that it would be better if all of their work for the first term or two were on macroscopic anatomy, and that the microscope should be brought in only when the student actually feels the need of it to pursue his investigations further. This is the method of nature, and it seems to me more profitable. C. D. M.

Ripon, Wis., March 30.

### Lepidoptera at sea.

On the evening of March 5, 1870, it was my fortune to be on board ship, bound from Callao for London, and at that time a little more than a thousand miles from Cape Frio, the nearest portion of the coast of Brazil. We were in latitude 25° south, longitude 24° west, just south of the border of the south-east trade-winds. Late in the afternoon we encountered several light squalls of wind and rain, during one of which two butterflies were driven past. The weather continued squally all night and for part of the next day, the wind coming from the westward. The following morning it was found that quite a number of Lepidoptera had been blown on board, and ensconced themselves in various places sheltered from the wind. They were mostly, if not wholly, nocturnal species of small size, although one large hawk-moth was among them. About twelve or fifteen specimens, representing nearly as many species, were captured, and others seen; so that not less than twenty or thirty individuals must have reached our ship.

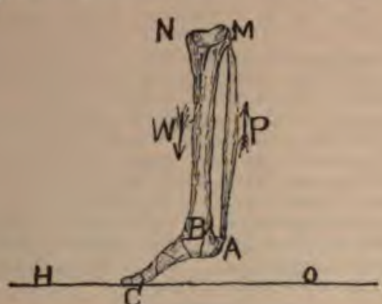
It would appear from this abundance that the total number swept out to sea must have been ex-

tremely large. Travelling even at the rate of forty miles an hour, these moths must have been on the wing at least twenty-four hours, in many cases exposed to the rain. The specimens captured seemed by no means exhausted, and could probably have prolonged their flight to a much greater distance. It has seemed best to place this occurrence on record even at this late day, as showing how readily islands may receive important additions to their fauna from very distant quarters. FREDERIC A. LUCAS.

Washington, March 30.

## On tiptoe.

The letter of Prof. F. C. Van Dyck (*Science*, ix. p. 235) in relation to the mechanical problem involved in standing on tiptoe seems to be somewhat misleading, in so far as he insists that it is *not* a lever of the *second* order. As the lever of the second order is defined to be that in which the weight, or resistance to be overcome, is between the fulcrum and the power, and as in this case the ground is the fulcrum, and the power is applied at the heel, it is evidently a lever of the second order. Moreover, if the power applied at the heel reacted on something exterior to the bony mechanism, the case would be simple and obvious. But inasmuch as the power, or contracting muscle of the calf of the leg, is attached both to the heel and to the head of the tibia, the efficacy of the power is thereby modified. But it does not alter the defined order of lever: it merely augments, to the extent of the reaction, the resistance to be overcome in raising the weight resting on the ankle.




Thus, in the annexed figure, assuming that the forces producing equilibrium act in parallel directions, and regarding it as a lever of centre of the second order, in which $C$ is the fulcrum or centre of moments, for conditions of equilibrium we have, $P \times CA = W \times CB + P \times CB \therefore P \times CA - P \times CB = W \times CB \therefore P \times AB = W \times CB \therefore P : W :: CB : AB$. Hence, while by the position of the fulcrum $C$ it is actually a lever of the *second* order, yet, by virtue of the reaction of $P$, it is mechanically *equivalent* to a lever of the *first* order.

In an analogous manner, it seems to me that the confusion and perplexity in relation to the 'boat-oar' problem might be cleared up (vide *Phil. mag.*, xxiii. pp. 58, 224, 1887). It is scarcely necessary to add that the foregoing solution of this problem is very old: if I am not mistaken, it may be found in one of the editions of Dr. Golding Bird's 'Elements of natural philosophy,' published more than twenty years ago. JOHN LECONTE.

Berkeley, Cal., March 23.

## The loss of the Tonquin.

It has generally been stated that the Tonquin, which figures so prominently in the history of the north-west coast, was destroyed at Nootka. Bancroft accepts this version in his 'History of the north-west coast' (1884); while others, following Greenow (1840), place the occurrence at Clayoquot, both these places being on the west coast of Vancouver Island. The facts so far as known, however, appear to me to point to Na-wi-ti, on the north coast of Vancouver Island, as the true locality.

The Tonquin, it may be remembered, was a vessel of 290 tons burden, belonging to Astor's American fur company. After reaching Astoria, in the mouth of the Columbia, in 1811, she was despatched on a trading-voyage to the north, leaving Astoria on June 5. It is unnecessary to detail the circumstances leading up to the attack on the vessel while at anchor, the massacre of the crew, and the subsequent explosion of the magazine, by which the vessel was destroyed and a large number of natives who had crowded on board were killed. The facts were subsequently obtained from a Chehalis Indian interpreter, who alone escaped, and are recorded by Ross Cox and by Franchere in 'The Columbia River' (1832) and 'Narrative of a voyage to the north-west coast of America' (1854) respectively. The name of the locality, as given by the Chehalis interpreter, is alone sufficiently distinctive, and I can account for the circumstance that its correspondence with Na-wi-ti has, so far as I am aware, been overlooked, only by the fact that this name has not usually appeared on the maps, though to be found as 'Nahwitti' on the detailed charts of the coast. Bancroft, indeed, denies the existence of any such name as that given by the interpreter and adopted by Franchere, and afterwards by Irving in 'Astoria' (*op. cit.*, p. 155).

The Indians known as the Nawitti by the whites, comprising the Tlā-tli-si-Kwila and Ne-kum'-ke-lis-la septs or tribes of the Kwakiool people, now together inhabit a village named by them Mel'-oopa, on the south-east side of Hope Island. Their original town was, however, situated on a small rocky peninsula on the east side of Cape Commerell, which forms the north point of Vancouver Island. Here remains of old houses are yet to be seen, and the place was and still is by the Indians known as Na-wi-ti.

Ross Cox, who came into personal contact with the escaped Chehalis interpreter, writes of the loss of the Tonquin, "A few days after their departure from the Columbia, they anchored opposite a large Indian village, named New-Whitty, in the vicinity of Nootka, where Mr. McKay immediately opened a smart trade with the natives." After giving the relation of the interpreter as to the massacre and explosion, he describes the escape of three (four according to Franchere) of the crew in a boat: "They rowed hard for the mouth of the harbor, with the intention, as is supposed, of coasting along the shore to the Columbia; but after passing the bar, a head wind and flowing tide drove them back, and compelled them to land late at night in a small cove," where they were afterwards found and killed by the natives. Franchere's version of the story is much the same with that of Cox, except that he gives the name as 'Newity,' and in another place as 'Newitti' (*op. cit.*, p. 180).

Though moderately well sheltered, the little bay at Na-wi-ti is stated in the *Vancouver pilot* to be unsuited for an anchorage by reason of its rocky bottom. It is nevertheless the first place on the north shore in which a seaman would naturally seek for an anchorage after rounding Cape Scott in the absence of a chart, and was, besides, adapted to the purpose of the traders as being the site of a large village. The mention by Cox of a bar over which a strong tide runs, again agrees with the fact of the existence of the notable 'Nahwitti Bar' of the charts, of which the writer had a somewhat perilous experience ten years ago, while bars are not found at the entrances of Nootka or Clayoquot sounds.

When at Na-wi-ti in 1885, I learned from the Indians that some disastrous event had happened at this place, but could not learn its precise nature. Dr. Franz Boas informs me that he also was unable to gather any thing definite on the subject from the natives. It is probable, however, that the shelling


of this village by a gunboat, which occurred about forty years after the loss of the Tonquin, may have since become confounded with that event, if it really happened at this place.

The point at which the Tonquin is supposed to have been destroyed is indicated by the asterisk on the accompanying plan, which is based on Admiralty chart No. 582. George M. Dawson.

Geol. surv. Can., March 30.

## A sensitive wind-vane.

The liquid damper suggested by 'T. C. M.' in *Science*, No. 217, certainly furnishes a complete and satisfactory solution of the wind-vane problem. This device is a customary method of checking oscillations, and its application to the wind-vane was made about ten years ago by Mr. J. W. Osborne, who constructed and used such an apparatus (*Amer. assoc. report*, 1878). His definition of an ideal vane agrees entirely with the conditions laid down by Professor Mendenhall, and is worth quoting: "A perfect wind-vane should instantly respond to the slightest change in the direction of the wind, and should remain stationary when it has made the necessary angular movement."

A single, but perhaps not unimportant, exception may be taken to Professor Mendenhall's solution,—"to use a *small* and extremely light vane." Lightness is, of course, a desideratum in order to reduce friction, but length is also requisite in order to give sufficient gyratory force for very light winds. The vane may be extremely light, and yet not small. Mr. Osborne's vane, designed to realize his definition, was *seven feet long*, and weighed only three ounces. Sensitiveness is increased, 1°, by increasing the moment of rotation; 2°, by diminishing the friction. An addition to the length of a vane, if it is of light material and mounted on friction-rollers, may add more to the sensitiveness by increasing the moment of rotation than it will subtract by increasing the friction. G. E. Curtis.

Washington, D.C., April 4.

The difficulties which have been discussed in the last few numbers of *Science* in regard to a sensitive wind-vane are avoided at Blue Hill observatory by having the wind-vane self-recording.

The recording is by the Draper method; viz., a cylinder is attached to the spindle of the vane, and a stationary pencil (except that it is slowly dropped by clock-work) records the oscillations of the wind on the cylinder. The vane is thin metal, has a divided tail, and is sensitive to the lightest wind. In order to determine the direction of the lightest or most violent wind, a line is drawn through the centre of the oscillations recorded on the cylinder. It is not uncommon for scud-clouds to drive by almost touching the top of Blue Hill; and, by means of a mirror devised for measuring cloud-movements, their motion can be determined within one or two degrees of arc. I have made a number of such measurements, and find that they correspond almost exactly with the centre of the wind-oscillations on the cylinder, determined in degrees of arc.

This method of recording the wind-direction is simple, accurate, and easily managed, and I do not think it would cost very much more than the method Professor Mendenhall suggests of fitting up the vane. Hence I hope, if improvements in wind-vanes are attempted by the signal service, they will turn their attention to the very desirable method of continuous registration. H. Helm Clayton.

Blue Hill meteor. observ., April 3.

## Physiology of plants.

I notice that in a review in *Nature* of the 26th of August, 1886 (p. 381), of Dr. Vines's 'Lectures on the physiology of plants,' it is stated that the view that "the cell-wall is produced by the actual conversion of a layer of protoplasm," and that "the starch which is formed in chlorophyll corpuscles under the influence of light is also the product of such a dissociation of protoplasm," is "the most striking novelty which will be found by English readers" in Dr. Vines's book, "and, though propounded some years ago in Germany, has now, we believe, appeared for the first time in an English text-book."

In reference to this, will you kindly allow me to point out that the above view was propounded by myself, and will be found fully set forth, along with an explanation of the chemical reactions involved, on pp. 218–223 of my book, 'Light the dominant force of the universe' (London, Sampson Low & Co., 1882). W. Sedgwick.

Calcutta, Feb. 15.

## Calendar of Societies.

*Philosophical society, Washington.*

*March* 30. — R. S. Woodward, On the free cooling of a homogeneous sphere initially heated to a uniform temperature; C. H. Kummell, The brachisthode on the helicoid, illustrated by stereoscopic diagrams.

*Biological society, Washington.*

*April* 2. — Theobald Smith, Quantitative variations in the germ-life of Potomac water during the year 1886; Edward Eggleston, Queries concerning certain plants and animals known to the earliest colonists of North America; Otis T. Mason, Representations of animal forms in Eskimo art; F. W. True, The black-fish of our southern waters; H. G. Beyer, The action of caffeine on the kidneys.

*Boston society of natural history.*

*April* 6. — Edward G. Gardiner, The development and homologies of hoofs, claws, and nails; S. H. Scudder, Fossil butterflies.

## Publications received at Editor's Office, March 28-April 2.

BEAL, W. J. Grasses of North America for farmers and students. Lansing, Thorp & Godfrey, pr. 457 p. 12°. $2.50.

BROWN, G. W. Baltimore and the nineteenth of April, 1861. Baltimore, Johns Hopkins univ. 176 p. 8°.

HUDSON, C. T The Rotifera, or wheel-animalcules. Parts iii.-vi. London, Longmans Green, & Co. [64] p. 4°.

IMPERIAL university, Japan. Journal of the college of science. Vol. i. part i. Tokyo, Japan, Imp univ. 112 p. 8°.

LADD, G. T. Elements of physiological psychology. New York, Scribner. 696 p. 8°. $4.50.

McCOOK, H. C. Tenants of an old farm; leaves from the note-book of a naturalist. 3d ed. New York, Fords, Howard, & Hulbert. 460 p. 12°. $2.50.

NEW JERSEY, report of the dairy commissioner of the state of, 1886. Trenton, John L. Murphy publ. co. 99 p. 8°.

OTIS, C. P., *ed.* Grimm's Maerchen. New York, Holt. 351 p. 12°. $1.25.

PECK, W. G. Elementary treatise on determinants. New York, A. S. Barnes & Co. 47 p. 12°.

REDWOOD, B. Petroleum, its production and use. New York, Van Nostrand. 210 p. 24°. 50 cents

SCHOOLTEACHER, the. Vol. i. No. 1. New York, A. S. Barnes & Co. 24 p. 4°. *m.*

## Advertised Books of Reference.

JOURNAL OF THE ELISHA MITCHELL SCIENTIFIC SOCIETY. To defray expense of publication this journal is offered at nearly cost. 3 vols. 350 pp. for $1.25. These contain biographies and portraits (two of them steel engravings) of Dr. Mitchell, Dr. Curtis and Dr. von Schweinitz, a complete flora and map of the Wilmington Section besides many botanical, chemical, biological, geological and meteorological articles. About 75 copies for sale. Address: F. P. Venable, Sec'y, Chapel Hill, N. C.

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MAMMALS OF THE ADIRONDACKS. By Dr. C. Hart Merriam. Contains an introductory chapter treating of the location and boundaries of the region, its geographical history, topography, climate, general features, botany, and faunal position. This work consists, in the first place, of a general account of the prominent features of the Adirondack region; and, secondly of a popular narrative of the habits of the animals found within its confines. Imp. 8vo. $3.50. Henry Holt & Co., New York.

SCIENCE ECONOMIC DISCUSSION. A controversy between the adherents of the old and new schools of political economy regarding their main points of difference, by Henry C. Adams, Richard T. Ely, Arthur T. Hadley, E. J. James, Simon Newcomb, Simon N. Patten, Edwin R. A. Seligman, Richmond M. Smith, and Frank W. Taussig. 12mo. Paper, 50 cts. Science Company, Pubs., New York.

LIPPINCOTT'S BIOGRAPHICAL DICTIONARY. A new, thoroughly revised, and greatly enlarged edition. A universal pronouncing dictionary of biography and mythology. Containing complete and concise biographical sketches of the eminent persons of all ages and countries. By J. Thomas, M.D., LL.D. Imperial 8vo. 2550 pages. Sheep. $12.00. J. B. Lippincott Company, Pubs., Philadelphia.

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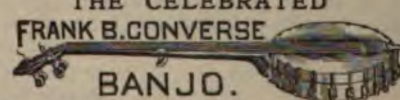


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# SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 8, 1887.

## *EFFECTS OF EXPLOSIONS ON THE EAR.*[1]

THAT the ear may be injured by the violence of aerial impact, or concussive force, propagated by the explosion of gunpowder, has been known ever since the introduction of explosives in military warfare. Owing, however, to the obscurity of traumatic lesions of the drum of the ear, or of its deeper parts, and the limited means of observation at the command of the military surgeon in the field, it has been more difficult to study these injuries than most other wounds. Such was my own experience, at least; and reference to the literature of the subject shows that the opportunities of writers on military surgery were probably no greater in this respect. It is a fact, moreover, that from the suffering occasioned by other and more painful wounds simultaneously received, together with the bewilderment caused by nervous shock, aural injuries are liable to be entirely overlooked. Indeed, in some of the cases about to be described, there were serious wounds of the ear, of which the wounded men themselves had been unconscious up to the time of my examination, several weeks after the accident. It may be stated here, on the contrary, that after artillery engagements it is not unusual for participants to fancy that deafness, due to other causes wholly, has been produced by the loud sounds of great guns; and, since the war of the rebellion, applicants for pensions not infrequently present their cases with the statement that aural disability has originated in this manner.

While the writer was recently seeking information from persons having had experience in the field or on shipboard, especially among army and navy officers, an opportunity quite unexpectedly presented itself to investigate thoroughly the effects of concussive force on the ears of a number of men in the midst of whom a twelve-inch mortar-shell, weighing five hundred and eighty-five pounds, and containing a bursting charge of twenty-seven pounds of rifle-powder, was accidentally exploded. This took place at the U. S. ordnance proving-ground, Sandy Hook, Oct. 21, 1886, at 3.30 P.M.

The scene of the catastrophe, as shown in fig. 2, was reproduced from a photographic view taken on the spot by my friend Mr. Walter C. Tuckerman. The men were taken in about the same positions they occupied at the time of the accident. The places of three of them — namely, Lieutenant Medcalfe and Private King, killed, and Corporal Goodno, absent in hospital — were occupied by other persons.

The diagram of the twelve-inch mortar, gun-carriage, and platform (fig. 1), where the firing was taking place, was kindly designed by Captain Whipple. The facings of the men are designated by arrows, and the direction and force of the wind at the time are also shown. The distance of the men from the shell which exploded was as given below: —

| | | |
|---|---|---|
| *A.* Sergeant Abbott, | position | 8 feet from the shell. |
| *B.* Private King, | " | at the base of the shell. |
| *C.* Lieutenant Medcalfe, | " | at the side of the shell. |
| *D.* Corporal Clark, | " | 4 feet from the shell. |
| *E.* Corporal Goodno, | " | 12 " " " " |
| *F.* Private Cunningham, | " | 15 " " " " |
| *G.* Private Cramer, | " | 15 " " " " |
| *H.* Mr. Sinclair, | " | 19 " " " " |
| *I.* Private Burns, | " | 19 " " " " |
| *J.* Corporal Ingram, | " | 16 " " " " |

Sergeant Abbott was blown ten feet from his position; Private King (who was closing the screw plug in the base of the shell with a drift and hammer, and thus exploded it) was instantly killed, and his body was blown fifty-five feet away; Lieutenant Medcalfe, who was standing by the side of the shell, was blown twenty-two feet, and died in thirty minutes; Private Clark was blown fifteen feet. The other six men kept their feet during the explosion. Eight men thus escaped with their lives, but all of them were more or less injured by the concussion, and some of them received contused wounds or were burned by the blast.

As might have been expected, the immediate effect of the severe concussion caused by the blast of the explosion just described was dumfounding in the extreme, so far as most of the persons in the immediate vicinity were concerned. The mental confusion which ensued in some of the cases lasted a long time, and in one instance, that of Corporal Clark, it is doubtful if complete recovery ever takes place.

In some of the cases the absence of prominent symptoms of injury of the ear, such as pain in the organ, tinnitus, deafness, or discharge, was noticeable. Soldiers are, however, as a rule, accustomed to endure hardship without complaint, and, in

[1] Condensed from the *Medical record* of Feb. 19, 1887, with illustrations reproduced by permission of Wm. Wood & Co.

fact, all insensitive persons are liable to overlook ear-disease until incapacitated to perform their work. It was only after persistent inquiries were made that some of these persons would admit that they had suffered any injury of the ear.

The extent of the injury of the drum of the ear in each one of the cases reported was dependent on the distance from the shell, the facing at the moment of explosion, and the size of the external auditory canal. In some instances, as, for example, in the cases of Abbott, Clark, Goodno, Ingram, and Sinclair, the drum-heads were driven in with

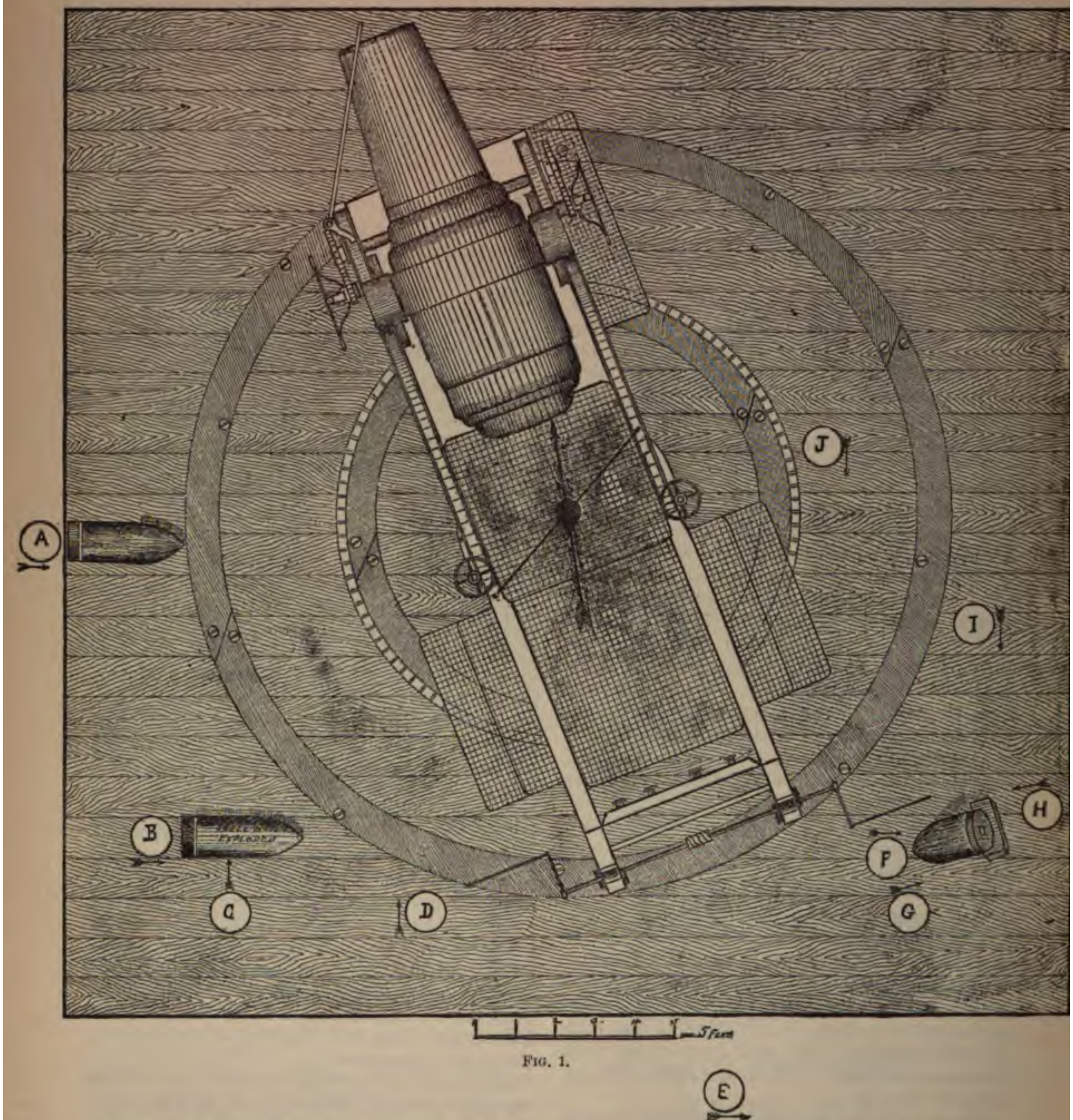


FIG. 1.

such force as to cause their complete destruction by death of the tissues. In some of the cases it will be observed that partial or entire reproduction of the drum-head took place. The spontaneous cure, in most of these cases, without leaving any discharge, affords a valuable suggestion in the treatment of inflammation of the ear, as well as in operations on the organ, in healthy persons. It is believed, notwithstanding the great destruction of the membrana tympani, that the chain of ossicles has been left in every case. It is fortunate for man that great augmentation of tension, exerted either from without or from within, upon the transmitting mechanism of the ear, may be experienced without serious injury to the stapes or labyrinth.

I have endeavored to obtain some reliable statistics in regard to the frequency of injuries to the organ of hearing during the late war of the rebellion, but without satisfactory results: thus, the number reported by the census-takers in 1880, as furnished me by Mr. Fred. A. Wines of the census bureau, was only fifteen from all causes. These are given below. The meagreness of facts obtained in this manner illustrates the inefficiency of such a method for collecting valuable information. A single shell-explosion has, in many instances, doubtlessly injured as great a number.

| | |
|---|---|
| Connecticut, 'discharge of cannon' | 1 |
| Georgia, 'firing cannon in war' | 1 |
| Indiana, 'cannon fired' | 1 |
| Illinois, 'gunshot wound' | 1 |
| Massachusetts, 'discharge of cannon' | 1 |
| Minnesota, 'from a shot' | 1 |
| Missouri, 'jar from cannon' | 1 |
| Nebraska, 'heavy cannonade in France' | 1 |
| New York, 'report of gun' | 1 |
| Ohio, 'discharge of cannon' | 1 |
| " 'severing of tongue cords by shot' | 1 |
| Pennsylvania, 'shot of gun' | 1 |
| Texas, 'gunshot wound' | 1 |
| " 'gun fired close to ear' | 1 |
| Wisconsin, 'firing cannon' | 1 |
| Total | 15 |

FIG. 2.

The pension-office, doubtless, might furnish more reliable statistics were the disabilities for which pensions were granted tabulated; but congress has, as I am informed by Medical Examiner Wood, omitted to make any appropriation for such work. It is to be regretted that more attention has not been given to this matter, since there must be a large number of persons who have suffered injury to the ears from the concussion of explosives, who are as much entitled to be pensioned by the government from this cause as from others which happen to be more easily diagnosed.

I have obtained some facts, in conversing with officers who served during the war of the rebellion, which may be of interest. Commander

Robeson, at the naval attack on Fort Fisher, found that the continued explosion of fifteen-inch shell at close quarters gave rise to very disagreeable ringing in the ears, which finally benumbed the hearing sense so much that he could not hear an order given on deck for several days: the disability, however, was but temporary.

I am in receipt of a communication from Medical Director Henry O. Mayo (retired), U.S.N., giving his own experience as to the effect on the ear of the concussion of great guns, which is of much interest, since it shows the effect of repeated injuries. He says, "I first felt the effects of concussion from big guns the summer of 1861, on board the frigate Savannah, while engaged in a scrimmage with some rebel gunboats at the mouth of the James River. As the affair promised to be of a bloodless character, from the respectful distance kept by the enemy, I seated myself in the bridle-port, on the gun deck, to watch the performance. My hearing was quite impaired for a day or two, but in a short time the effects of concussion passed off entirely.

"Just at the close of 1864, I was attached to the U. S. steamship Powhattan, of Admiral Porter's fleet, and was engaged five days (three at one time and two at another) in the bombardment of Fort Fisher and the other batteries at the entrance to Wilmington. Having occasion to go on deck at times during the action, I could only do so by the cabin companion-way, which was but a few feet from the eleven-inch pivot gun. This chanced to be discharged two or three times, just as my head was about on a level with it, going up or down the hatch, and the concussion was tremendous. Once I thought the gun had burst, and taken my head along with it. Upon reaching home, a month or two afterward, I found the hearing of the left ear much impaired, but the right still served me so well that I was enabled to continue my ordinary duties on the active list.

"In the early part of 1870 I went to China as surgeon of the Asiatic fleet. During this cruise I was exposed for one entire day to the concussion of big guns engaged at target-firing on board the flagship Colorado. This gave the *coup de grace* to the hearing of the left ear, and still further impaired that of the right. In 1875 I was retired on account of deafness."

Dr. Mayo is of the belief that the cause of the defectiveness lies in the transmitting mechanism of the middle ear, and not in the inner ear, or auditory nerve-tract. The Eustachian tube of the left (worst) ear has always seemed abnormally pervious, while the right was considerably obstructed. He cannot hear the loudest-ticking watch pressed against the left ear, and only faintly in the right. He can converse pretty well with *one* person, at close range, who speaks slowly and distinctly.

In general, it may be said that the concussion of great guns is much less in the rear of the piece than just over it or at one side, and that the more in advance, the greater the exposure to the blast. On shipboard a gun's crew is usually stationed from four to eight feet to the rear of the muzzle, and, when protected by bulwarks and decks, experience no special inconvenience; but, if the ear happens to be on the same plane as the face of the muzzle, the effect at a distance of a few feet is disagreeable, or even painful, and causes temporary deafness.

The force of impact upon the drum-head will depend somewhat on the size and curvature of the external auditory canal and the rigidity of its cartilaginous walls: of course, the more straight and large the passage, the greater the injury.

The size and tensile strength of the drum-head must be taken into account: if large and brittle, from trophic changes, it is much more easily ruptured.

The facing of the person exposed must also be considered: usually the ear directed toward the object from which the concussive force is propagated suffers most; but in the case of Ingram it was otherwise, the sound-waves having been reflected.

The immediate effect of the blast-impact in the cases injured by the shell-explosion at Sandy Hook was undoubtedly upon the exterior surface of the drum-head mainly. While it is true that atmospheric tension is almost equal on both sides of the drum head, yet a current of air passes much faster along the comparatively large tube comprising the external auditory canal than along up the small Eustachian tube; and hence, in most of these cases, the drum-head was driven in with great force, and contused against the inner wall of the tympanum and the retained air. The effect of such violent concussion is to cause the death of the membrane.

The momentum of sound-waves may ordinarily be estimated by the application of the law of central forces, the force being inversely to the square of the distance. The effects, practically, of such intense concussive force, however, cannot be measured by rules governing sound ordinarily, since it has been found by experience, that, instead of finding himself surrounded near the breech of the gun by highly rarified air, the experimenter may be subjected to quite an opposite condition; namely, one of condensation. In the former, intra-tympanic air would rush outwardly, carrying the drum-head before it. In confirma-

tion of this allegation, the puzzling experience related to me by Captain Shaler may be cited : "The window-glass of the officers' quarters, at the testing-grounds at Sandy Hook, situated some three to five hundred feet to the westward of the gun park shown in the picture, are liable to be shattered by the concussion of large pieces in practice, and it has been found that the glass is forced *outward* at one time, and *inward* at another." Regarding the drum-heads as window-glass under like conditions, we might find them ruptured by compression from without in one instance, and by distention of intra-tympanic air in another.

All of us are aware of the difficulty of ascertaining the source of sound in a sea-fog, where vapor-tension varies in a much greater degree than inland. Professor Henry described the reflections of sound which here take place as 'acoustic shadows,' — a picturesque comparison, recognizable by every one familiar with those similar phenomena, namely, the reverberatory detonations of thunder during a storm, where clouds or mountain-peaks intervene. It is to the unrecognizable 'vapor-peaks' that many unexplained and puzzling acoustic manifestations are due. In the case of Corporal Ingram, cited, the wave from the blast did not nearly so much affect the right ear, which was turned toward the shell, as the left one, the sound having been apparently deflected from its course by the heavy gun-carriage intervening.

Experiments are wanting to determine the windage [1] of balls. This must depend on their size and velocity, nearness of passage, and the force and direction of the wind. There seems to be no doubt but that the windage of a cannon-ball might rupture the drum-head of the ear. The compression of the air before and around the ball, I am informed by my friend Prof. A. M. Mayer, is considerable ; and the *velocity* of the compression is equal to that of the ball, which velocity may even exceed that of wind itself. So an *aerial blow* of such a mass of air, at such high velocity, is probably quite sufficient to rupture the drum-head.

The size and force of modern military explosives having been greatly increased of late years, much more injury to the ear is likely to occur in future than has been recorded of the past, though the number of accidents from premature discharge, or from exposure to the blast in firing breech-loading pieces, must be less than when muzzle-loaders were in vogue.

It is the experience of many officers that the vibrations of great intensity which are given off from some field-pieces and bursting shells, charged with high explosives, are more disagreeable than the heavier sounds of great guns. The metal itself vibrates under these circumstances similarly to a tuning-fork.

A very disagreeable jar is imparted to the temporo-maxillary articulation when the individual is near a great gun being fired off. This is lessened, it is believed, by standing on the toes and leaning forward. Some simple precaution, to be employed by officers and men during artillery practice, would seem very much needed, since aural shock is not only painful and distressing, but orders cannot be well heard while the confusion lasts.

There is probably no better protection than a firm wad of cotton-wool well advanced into the external auditory canal. In suggesting this protection, it is believed that harm can seldom take place from pressure of air from within, since it is known that the violent introduction of air into the tympanum from the throat, by means of Politzer's method of inflation, seldom ruptures the drum-head ; though, if such a volume of air were suddenly driven into the external auditory canal, the drum-head would in nearly all cases be ruptured.

The writer, in finishing this account of the aural injuries done by the explosion, would request that other observers having experience in this direction kindly communicate with him. Any knowledge that may thus be contributed would be of service to military surgeons, otologists, and others.

SAMUEL SEXTON, M.D.

[1] 'Windage', it should be said, is a technical term used in military parlance to indicate the difference in diameter between the bore of a gun and its projectile. The wo d has been, perhaps improperly, adopted by writers on military surgery, in which sense it refers to the impact of the condensed air surrounding a missile passing near any part of the body.

## MINING INDUSTRIES AND MINERAL RESOURCES OF THE UNITED STATES.

*Tenth census of the United States.* Vol. xv.: Report on the mining industries of the United States (exclusive of the precious metals). By RAPHAEL PUMPELLY. Washington, Government. 4°.

THIS report supplements those previously issued on the precious metals, and on petroleum, coke, and building-materials ; and these volumes together constitute a very complete account of the mining and quarrying industries of the country for the census-year.

The appearance of this volume, nearly two-thirds of a decade after the close of the census-year, is neither timely, nor creditable to those responsible for the delay ; for the practical interest and usefulness of works of this class, except, perhaps, for students of economics, diminish rapidly

with the lapse of time. Fortunately, however, this volume also possesses features of more permanent value than mere statistics, to the students of American mining and geology. This is especially true of the extended section on the iron ores, which certainly is a boon to every student and teacher of economic geology. The treatment, both statistically and geologically, is well-nigh exhaustive. The geologist will find here a profusion of maps, sections, and diagrams, showing in all desirable detail the geographical and geological distribution of all the principal varieties of iron ore mined in this country; with an account of the extent, structural characteristics, and chemical composition of every important deposit, and, in most cases, of every important mine. The geological material, where not original, is collected from widely scattered and comparatively inaccessible sources; so that, even if regarded merely as a compilation, this treatise on the sources of our most valuable metal ranks, as a contribution to the popular knowledge, with the most important monographs of the national survey. Of the statistics of the production of iron ore in the census-year, it is sufficient to say, that, like the statistics of the tenth census generally, they are very full, and are presented in every interesting and instructive aspect.

The section on the iron ores is followed by that on the coals: and this part of the report is, for the eastern United States, very summary, and chiefly statistical: the statistics being illustrated, however, by a series of maps showing the general distribution of the coal-measures, and the production by counties. In his meagre description of the coal-fields of the eastern United States, Professor Pumpelly has evidently been influenced by the fact that very satisfactory accounts of most of them are now accessible to the public in various general works and state reports, and especially in the report of the second geological survey of Pennsylvania.

But any deficiency here is fully compensated in the very full report on the cretaceous coals and lignites of the north-west, especially on the line of the Northern Pacific railroad, in Montana and Washington Territory.

In short, Professor Pumpelly has made this volume a medium for the publication of some of the results of the northern transcontinental survey, carried on for two years (1881–83) under his charge. It is a substantial and timely contribution to our knowledge of the geology and resources of the most imperfectly known section of the country. The report is profusely illustrated by beautifully drawn maps and sections.

The remainder of the volume is devoted mainly to the usual statistics of the production of the base metals, — copper, lead, zinc, — and of the minor economic minerals, such as mica, asbestus, asphaltum, barytes, chromic iron, emery, graphite, kaolin, etc.; but it concludes with an extended and well-arranged directory of the mines and metallurgical establishments east of the 100th meridian, and of the mines of bituminous coal and lignite in the eastern states and territories.

*Mineral resources of the United States*, 1885. By DAVID T. DAY. Washington, Government. 8°.

This is the third of the series of annual octavo volumes on the development and production of the mines of the country, published by the U. S. geological survey; and since it represents the condition of the mining industries at the middle of the decade, it supplements in an important way the census volumes already referred to, bringing the statistical portions of these, especially, nearly up to date. These annual volumes cover the entire range of economic geology, including building-materials and fertilizers, and, besides the statistics of production, are replete with descriptions of new developments, and notes on the condition of allied industries, and on processes for utilizing materials which have no value at present.

## *SOME AGRICULTURAL REPORTS.*

*Report of the viticultural work during the seasons 1885 and 1886.* (Univ. Cal. coll. agric. rept., 1886, Appendix No. 6.) By EUGENE W. HILGARD. Sacramento, State. 8°.

THIS report records the continuation and extension of Professor Hilgard's well-known viticultural work of former years, which has done so much towards developing the wine industry of California, and placing it upon a rational basis. The general scope and purpose of this work, as defined by Professor Hilgard, is to aid in "the establishment of more definite qualities and brands, resulting from a definite knowledge of the qualities of each of the prominent grape varieties, and of their influence upon the kind and quality of the wine in blending."

With this end in view, work has been done chiefly in three directions, — first, as a means of rectifying nomenclature and aiding in identifying varieties, a standard vine collection is being formed; second, a considerable number of samples of grapes have been made into wine on a small scale at the viticultural laboratory, and the course of the fermentations and aging of the wine and the quality of the product have been followed; third, representative samples of wine from different localities, and different varieties of grapes, have been analyzed. Some comparative experiments upon different methods of fermentation

have also been made, and a considerable amount of work upon vine-diseases is reported.

*Annual report of the Connecticut agricultural experiment-station, for* 1886. New Haven, State. 8°.

Like most of the experiment-stations of the eastern states, the Connecticut station is largely occupied with the analysis of commercial fertilizers; about one-half of the space in the report for 1886 being occupied with the results of this work, while a considerable portion of the remainder is taken up with the analyses of feeding-stuffs sent to the station for examination, and other matter connected therewith.

Numerous analyses of milk and of butter and butter substitutes have been made, the latter for the state dairy commissioner, and also a few ash analyses of feeding-stuffs.

The most noteworthy portions of the report are the papers upon 'The agricultural value of horn-dust and of hoof and horn,' and upon 'Methods of mechanical soil analysis.'

In the former the method of pot experiments with fertilizers, worked out with great care and labor by Wagner, was applied, for the first time in this country, so far as the writer is aware, to the solution of an important practical question. It is to be hoped that further experiments of this sort by this and other stations may supplement their work on the analysis and commercial valuation of fertilizers.

The paper upon 'Methods of mechanical soil analysis' gives the results of tests of a new method, styled 'beaker elutriation,' by which a soil may readily be separated into sediments of any desired fineness in a very simple and expeditious manner, and without the use of expensive apparatus. Should the method prove, upon further trial, to be as accurate as these trials indicate, it will be a very substantial addition to our means of studying the physical properties of soils and their relations to fertility.

Mention should perhaps be also made of the notes upon analytical methods, which contain much of interest to the chemist. The report, as in previous years, shows that the work undertaken has been most thoroughly and conscientiously done. One can but regret that so great a proportion of the time and energy of the station's officers is taken up by routine work, and so little is available for really scientific investigation.

*Fifth annual report of the board of control of the New York agricultural experiment-station, for the year* 1886. Elmira, Advertiser assoc. pr. 8°.

As in previous years, the report of the New York experiment-station is largely devoted to the elaboration of the directors' idea of an agricultural botany; wheat, cabbage, and lettuce being the plants chiefly studied during the year, — the first by the first assistant, and the other two by the horticulturist. The attempt is made to classify the large number of varieties given and described into 'agricultural species' with distinct and reasonably permanent characters. It would appear that the success of the gentlemen interested with these tasks has not always been commensurate with their desires; but this was to be expected in such a comparatively new field, and any very vigorous criticism of the results would be premature.

In connection with these studies, a large number of collateral points have received more or less attention, many of them important in themselves, but so superficially treated as to render the results of the trials of little or no value. It seems to be very difficult for those in charge of these experiments to restrain themselves from following up for a little distance any collateral inquiry which suggests itself, and hence their work suffers from a certain lack of concentration.

In this latter respect the reports of the botanist, chemist, and assistant chemist contrast favorably with those just spoken of; in part, doubtless, on account of the nature of the work undertaken. The paper on 'Viscometry,' by the chemist, deserves more than a passing notice. By means of a simple and inexpensive apparatus he is able to determine with great accuracy the relative viscosity of liquids, and to show that it varies greatly as between different liquids, and may be made a very delicate means for detecting adulterations in certain cases. The method has thus far been applied chiefly to dairy products, and with very satisfactory results, although the investigations are not yet completed.

The New York report, as a whole, contains the records of a vast amount of labor; but in many cases it is only a record, and nothing more. While this is necessarily the case with large portions of the work, there are other portions whose value is practically lost for lack of a careful discussion of the results, and the value of the whole to the ordinary reader would be greatly enhanced by a more free employment of the resources of typography to indicate the divisions and subdivisions of the subjects considered.

## CHALLENGER REPORTS.

THE present volume is devoted to the Crustacea (Isopoda, part ii., and Brachyura) and Polyzoa (part ii.).

In his first report on the isopods, Mr. Beddard dealt exclusively with the Serolidae; and the

*Report of the scientific results of the exploring voyage of the Challenger.* Zoölogy, vol. xvii. London, Government. 4°.

esent part takes up the other families, and com-etes the description of this group. He has nitted detailed descriptions of species obtained y the Challenger but already known to science, xcept where needed for comparison with new orms; but when from a new locality or habitat, he fact has been recorded.

The Challenger collection is very rich in new pecies, especially among the deep-water forms, of which no less than thirty-eight are new to science. Among the shallow-water forms the greater number of novelties were from the neighborhood of Kerguelen and Australia. The benthal region is very irregular in its isopod fauna, if the dredgings of the Challenger afford a criterion. Over the central and southern Atlantic and central and western Pacific no species at all were found; but where any occurred, they seemed to comprise a considerable variety of forms. Thirty-four of the abyssal isopods are totally blind, three appear to have degenerate eyes, while eighteen have well-developed eyes. But of the eleven genera exclusively resident in the deep water, only two have eyes; of those remaining, seven belong to genera which in shallow water always have eyes; while the remaining eighteen species belong to genera which are blind whether in deep water or not. The differences are not easily explained. That some species should retain and others lose their eyes under apparently similar conditions, it is difficult to account for. Mr. Beddard suggests that those retaining eyes are probably the later emigrants to the abysses from the shallows.

The deep-sea isopods are remarkable for the development of spines on the body, especially in the Arcturi, and often attain extraordinary size; one, Bathynomus giganteus, reaching a length of nine inches. In these tendencies the abyssal species resemble those of the polar seas, where the temperature conditions are not dissimilar.

The report on the Brachyura, by Edward J. Miers, is devoted to a systematic account of the numerous species collected, with revision of the classification, and lists, as complete as possible, of the recent species of each genus not included in recent and accessible monographs. The genera have been rediagnosed on a uniform plan, thus furnishing a most useful supplement to these monographs, and preparing the way for a catalogue of the Brachyura, — a work much needed by students of the higher Crustacea. The author regrets that ill health has prevented him from adding a bibliography and other useful details, and even from personally revising the proofs, and in general attaining the high standard of perfection which he aimed at, though doubtless such faults or deficiencies are much more apparent to him than to those who will gratefully appreciate and use the results of his arduous studies.

The abyssal region of the ocean affords no Brachyura at all, but few occur in depths of over five hundred fathoms. The great mass of the collection is from shallow waters, and its novelties chiefly from the less-explored coasts and islands of the Indo-Pacific region. There were but two species, both belonging to the genus Ethusa, taken in over one thousand fathoms: one of these, E. Challengeri Miers from 1875, is from the greatest depth recorded for any true crab.

The report on the Polyzoa Cyclostomata, Ctenostomata and Pedicellinea, by George Busk, possesses a melancholy interest as the last production of that veteran and indefatigable naturalist. The revision of the proofs was performed by him only a few weeks before his death.

Forty-six species were collected by the Challenger, of which thirteen are regarded as new. Of the thirty-three cyclostomate forms, thirteen had previously been known in a fossil state. This group alone reaches deep water; and of the species, only two were obtained from more than one thousand fathoms, and none from over fifteen hundred fathoms. One of the above dredged in sixteen hundred fathoms is also known from various depths up to fifty fathoms. None of the forms described appear to be particularly remarkable.

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DR. CHAPMAN, in the *Medical and surgical reporter*, says that nine-tenths of wild animals in confinement are subject to heart-disease, although all animals have their peculiarities. The elephants are heirs to many diseases, but the most common and fatal is rheumatism. Monkeys and baboons generally die from bronchial affections and heart-disease; felines, such as lions, tigers, leopards, etc., from dysentery and heart-disease; deer, antelopes, etc., suffer most from dysentery and heart-disease; while the canine tribe, such as wolves, dingoes, and foxes don't seem to be subject to any disease except 'pure cussedness.' The only thing to be feared in the wolf tribe is too much sociability. It is unsafe to keep more than a pair together; otherwise they would eat each other.

— Under a law which has just passed the Minnesota legislature, the restrictions placed upon the practice of medicine in that state will be more severe than in any other part of the United States. All persons who wish to practise medicine after July 1 must pass an examination before a board of nine persons, irrespective of whether they hold regular diplomas or not, and only those who have taken three courses of medical lectures will be permitted to the examination.

# SCIENCE.

FRIDAY, APRIL 15, 1887.

## *COMMENT AND CRITICISM.*

WE DESIRE TO OFFER to our readers from time to time discussions on questions of present educational interest by men of prominence in the teaching profession. The first of these discussions is printed in this issue, and deals with the question as to what industry can profitably be introduced into country schools. The contributors are Pres. Francis A. Walker of Boston, Charles H. Ham of Chicago, and Superintendent Samuel G. Love of Jamestown, N.Y. The question was put as to country schools because there are certain conditions peculiar to them. As a rule, they are not so carefully organized nor so well managed as city schools. Their resources are usually less, and their opportunities fewer, than those possessed by the schools of the town or the city. And in this one particular of the introduction of an element of industrial training, the country school is at a disadvantage. It is cut off from using many forms of industrial training that are at hand in the city; and on this and other accounts it merits separate consideration. It is to be borne in mind that industrial work can only find access to the schools in so far as it is educational. As manual or technical instruction, there is no room for it save in institutions created especially for it. The schools can, must, and will welcome it as an educational factor. Its theoretical value is conceded: it remains to solve the practical questions as to just how it can be introduced. What changes must be made to accommodate it? What re-adjustments and re-arrangements are necessary? These are pressing questions just now.

GEN. JAMES B. FRY, in a paper on compulsory education in the army, takes occasion to go at length into the subject of public-school education. In fact, this forms by far the larger portion of his pamphlet, the considerations relating to the army being relegated to a few pages at the end. General Fry's language is strong and direct, and he is very much opposed to compulsory education in particular and to the public-school system in general. His argument is, in brief, that compulsory education by the state involves a pernicious assumption of power, and that the state's expedients and processes necessarily call for official surveillance and intermeddling, which, to be effective, must be arbitrary and vexatious, and which are hostile to our institutions and to the feelings of self-reliance and personal independence born and bred in our people. It deprives parents of responsibility for their children, the writer contends, and does this at the expense of a part of the community; and, however high its pretensions, it cannot be free from the demoralization that results from giving alms by law.

We must confess that this seems to us very silly. General Fry appears to have fallen a victim to platitudes and that most curious cry of 'pauperizing the intellectual classes' which is now so often heard. To which of our 'institutions' is the public-school system hostile? We have an idea that it is the chiefest of them as well as their centre. This subject has been gone over so often that it is hardly worth while treating it again. But we could not resist the temptation of merely indicating how even so serious and well-meaning a writer as General Fry may be totally misled by words, when he does not pause to weigh carefully the ideas for which they stand.

WHY THE WALLS of the stomach and intestine are not themselves digested by their own fluids has for more than a hundred years been a mooted question in physiology. John Hunter, in a paper read before the Royal society in 1772, maintained that it was because these tissues were living, or, as he expressed it, "animals, or parts of animals, possessed of the living principle, when taken into the stomach, are not in the least affected by the powers of that viscus so long as the animal principle remains; hence it is that we find animals of various kinds living in the stomach, or even hatched and bred there: yet, the moment that any of those lose the living principle, they become subject to the digestive powers of the stomach." Other theories have been advanced to explain the facts in the case, but all are unsatisfactory. Dr. J. W. Warren contributes an article to the *Boston medical and surgical journal*, in

which he reviews the evidence presented by those who have maintained these several theories, and gives the results of some twenty experiments of his own made on fifty frogs. He suspended the legs of the frogs while living in an artificial gastric juice (that is, pepsin and hydrochloric acid), and found that the muscular tissue was digested, as was shown by the presence of peptone, the frog remaining alive throughout the experiment. When acid alone was used without the pepsin, the muscle was softened and dissolved, but not peptonized, and therefore not digested. It thus appears that living tissues may be digested, and that the problem is as far from solution as ever. Dr. Warren comes to the same conclusion, but promises to investigate the subject more fully in the future.

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IN A RECENT NUMBER of *Science* we referred to the experiments of Dr. T. M. Prudden on bacteria in water, with special reference to the ice-supply of New York City. These experiments were not confined to the water, but included also the ice itself. These observations show that ice formed in the Hudson River near Albany contains vastly greater numbers of bacteria than that found at some distance below, but that, notwithstanding the fact that the water of the river is freed to a certain degree from bacteria after running some distance, the average number of bacteria left in the ice is considerably above that which can be regarded as wholly safe. Samples of ice from the various lakes and ponds from which the supply of New York is taken have also been analyzed. The general conclusions to which Dr. Prudden has arrived may be thus summarized: 1°. A biological analysis of water and ice will detect the presence of bacteria, some species of which can give rise to serious disease, but a great deal of careful study of other conditions is still necessary in order to determine whether the water or ice is suitable for use or not; 2°. In freezing, water purifies itself only partially, the gross particles and some of the materials in solution being removed, but the bacteria remain to a considerable extent unaffected; 3°. Different species of bacteria possess differing degrees of vulnerability to the action of low temperatures; 4°. The bacillus of typhoid-fever and the common bacteria of suppuration are capable of resisting a prolonged exposure to a low temperature with the destruction of a part only of the individuals thus exposed; 5°. Experimental data justify the belief that in natural waters there may be a purification of about ninety per cent; 6°. In filtration of water the various species of bacteria, dangerous and harmless, are eliminated with about equal efficiency, while in freezing the dangerous disease-producing species may be retained if they resist low temperatures, while more or less of the harmless forms may be destroyed; 7°. The ice supplied to New York comes from a series of naturally excellent lakes and ponds, and from a great tidal river largely contaminated in its upper regions, and by far the larger proportion of the ice comes from the latter source; 8°. A very much greater number of bacteria are found in snow-ice and in the very bubbly streaks than in the transparent ice, particularly in the snow-ice on the top of the cakes; 9°. The average number of bacteria in ice from all sources taken together is far beyond the general standard which even a moderate degree of purity would allow; 10°. The transparent ice from some of the lake and pond sources presents in general a most admirable degree of freedom from bacteria.

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In interpreting the results which he has reached, Dr. Prudden states that typhoid-fever, and diseases associated with acute suppuration and the so-called blood-poisoning from wounds, or pyaemia, are almost constantly present in large towns like Troy and Albany, and frequently so in villages like many of those which lie along the upper Hudson; and that his experiments have shown that the bacteria causing these two forms of disease are markedly resistant to the temperature at which ice forms. He estimates that in Albany alone, there are, on an average, fifty cases of typhoid-fever whose excreta pass into the Hudson River each year during the ice-forming season. He also finds that in that city there is no systematic disinfection of the typhoid discharges, which therefore enter the sewers, and subsequently the river, with their myriads of bacteria in a living condition. Dr. Prudden recommends that the state board of health, or other authority, shall have full control of the ice-harvesting fields, and determine which, if any, of the sources of ice-supply are so situated as to imperil the health of the consumers of the ice. In addition to this, a compulsory system of disinfection of excreta in infectious diseases should be instituted. He also thinks that artificial ice might, perhaps, be substituted for the natural ice. In concluding his very valuable paper, the writer expresses his sincere hope that his

study and conclusions may not be looked upon in a sensational light, nor regarded as a polemic against ice companies and dealers, or against the free and wonted use of ice, the incalculable usefulness of which is beyond question. His researches have been carried out at great expenditure of time and money, in the hope, that, in the light of its results, the rapidly developing discipline of preventive medicine might find a plan of curtailing, in some degree, the number of annual victims to preventible disease.

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When the student is translating from a foreign language, especially from the classics, the teacher is very apt to measure the quality of the performance by the literalness of the translation. Every preposition, every interjection, every case or tense signification, must find verbal expression in English, no matter at what sacrifice of sense and spirit. But translation is not the same thing as transliteration. The student's aim should not be to get the Greek or Latin words into English, but to convey the sense and spirit of the writer. We are convinced that this is one of the most prominent faults in the classical instruction of the present. And it does not end in the mere use of language. It has a narrowing, cramping influence on the mind, instead of developing that breadth of view and comprehension which ought to come from classical study. It is surprising, too, how great an influence for evil this ultra-literal translation has on the student's English style. We have known numerous instances where the peculiarly Greek and Latin idioms have been quite as numerous in a composition or essay as the English. The result is, naturally enough, a forced, artificial, and awkward style. Our classical teachers, especially those who have the supervision of the younger pupils, cannot be too careful in demanding a translation which shall not neglect the spirit while it interprets the letter of the author.

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The report of the special committee of the American public health association on the disinfection of rags contains a complete summary of all the evidence which has thus far been accumulated, in this country and Europe, in reference to this article of commerce, and the dangers connected with it. The greater part of the report was submitted at the Toronto meeting of the association. A letter from Dr. Sternberg to one of the members of the committee, giving the results of his investigations abroad, has been appended to the report. In it Dr. Sternberg says he made inspections at Ghent, Brussels, Berlin, and Stettin, and obtained reliable information as to the methods pursued in Hamburg and other German ports from which rags are shipped to this country. He had previously supposed that rags from ports in southern Europe, where cholera was prevalent, were liable to be shipped from any of these ports; but he was assured that this could never occur, on account of the low price of rags as compared with the cost of land transportation. As a matter of fact, rags sent to each shipping-port can only be collected within a limited area, the boundaries of which depend upon cheap transportation facilities by canals, rivers, etc. He regards it as incumbent upon all sanitarians to insist upon the proper protection of all those who are brought by their occupation in contact with old rags. If this is done, the danger will be reduced to a minimum; and if the community is fully protected in the same way as is the case in Germany, there will be no good reason for disinfecting rags in the bale. He considers it as desirable that all old rags should be disinfected by steam, and dried, before being baled. During the prevalence of cholera, all old rags from ports known to be infected, or in direct communication with infected places, should be excluded. He would require all rags shipped from a healthy port during the prevalence of cholera in Europe to be disinfected by steam before being baled for shipment. In the absence of any prevailing epidemic, baled rags should be treated as other merchandise. If any merchandise is dangerous, it should be disinfected, and this can be done most effectually by steam.

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The epidemic of scarlet-fever attributed to the milk of a sick cow, to which we referred in a recent number of *Science*, has been still further investigated by Dr. Klein, for the British government. A micrococcus was obtained from the ulcers of the sick cow, which, when inoculated into calves, produced the same lesions as existed in the cow from which they were taken. Dr. Klein has found in the blood of scarlet-fever patients a micrococcus which appears to be identical with that obtained from the cow. He has inoculated and fed mice with the micrococci from these two sources, and the same results have been produced. He has also obtained the same micrococci from the blood of these mice, and cultivated them. The same inoculations have been made

upon calves, with the same results. If these observations are confirmed by further experiments and other experimenters, the micro-organism which has been so long undiscovered, and which causes tens of thousands of deaths annually, may soon be added to the list which now contains that of tuberculosis, typhoid-fever, and a few other diseases.

## *THE AMERICAN SCHOOL OF CLASSICAL STUDIES AT ATHENS.*

THE opportunity which is just now presented to the managers of the American school at Athens to secure an efficient, permanent director, brings the claims of this useful enterprise with fresh strength before the scholars and promoters of learning in America. Dr. Charles Waldstein, the accomplished archeologist, who is a citizen of New York and a former student of Columbia college, but who now holds two important positions at the University of Cambridge, England, as lecturer on archeology and director of the Fitzwilliam museum, has accepted the invitation of the managers to assume the directorship, upon the condition that a permanent endowment shall be secured for the school, sufficient for its legitimate needs, before the 1st of October, 1888, when the appointed year of Professor Merriam of Columbia college will end. A writer in the London *Saturday review* for Sept. 26, 1885, gives an intelligent and highly appreciative account of the work done by the American school, but makes this forcible criticism: "Undoubtedly the weak point of the whole American scheme is the fact that the director goes out for a year only. America can send a succession of good scholars, but she cannot send a succession of men capable of teaching archeology; indeed, a student who remains at Athens longer than the regulation year might easily become more learned in that pursuit than his director. Thus the head of the school cannot instruct his students, but only work with them, and they must pick up their knowledge from books as well as they can."

The American school of classical studies was projected by the Archeological institute of America (of which Prof. Charles Eliot Norton is the president), and was organized under the auspices of some of the leading American colleges. The director of the school was to be chosen from the professors of Greek in these colleges, by a committee appointed by the Archeological institute. The school was opened on the 2d of October, 1882, under Prof. W. W. Goodwin of Harvard university. Its object was to furnish to graduates of American colleges an opportunity to study classical literature, art, and antiquities in Athens under suitable direction; to prosecute and to aid original research in these subjects; and to co-operate with the home institute, so far as possible, in conducting the exploration and excavation of classic sites. The salary of the director was to be paid by his own college, and no fees were to be charged to the students. The boldness of this enterprise was peculiarly American, for, while the older French and German schools had been maintained for many years by the liberality of the two governments that founded them, the projectors of the American school relied with confidence upon the willingness, and even eagerness, of our intelligent men of wealth to take the place which ancient governments fill in Europe, as patrons of learning.

The American undertaking instantly presented a stimulus in the same direction to English scholars; and within three years we find Dr. Lightfoot, the bishop of Durham, urging his countrymen to emulate our example in establishing a school at Athens. He said at a public meeting in London, in 1885, "It now touches our honor as Englishmen very nearly that this scheme should be carried out without delay. France and Germany have long been in the field. France has her school, and Germany her institute; and even America has forestalled her in this race. That new country, notwithstanding the vast and absorbing interests of the present, notwithstanding the boundless hopes of the future, has been eager to claim her part in the heritage. While all the civilized nations of the world, one after another, are establishing their literary consulates in Athens, shall England alone be unrepresented at this centre of Hellenic culture?"

These words, supported by the earnest appeals of Dr. Hornby, provost of Eton, Prof. R. C. Jebb, and other distinguished scholars, produced the desired effect, and a British school is now established in Athens.

The American school has now nearly completed its fifth year of work, with increased numbers of students and every prospect of increasing usefulness. It has up to this time occupied a hired house, and has been entirely supported by the annual contributions of fourteen colleges, from which the house-rent, the appropriations for the library, and incidental expenses, have been paid; each college, in its turn, sending a professor to Athens as director for one year without expense to the school. With these temporary and imperfect arrangements, much valuable work has been accomplished by the school, which has received cordial recognition both at home and abroad. "Now," as the managers say, "a new era is to begin. We are henceforth to have a home of our

own. The government of Greece has shown such warm interest in our enterprise, that a valuable piece of land on the slope of Mount Lycabettus, containing an acre and a half, has been granted to the school by a royal edict, issued July 25, 1886, and signed by seven ministers of state."

This generosity of the Greek government has already been so well seconded by friends of the school in America, that sufficient funds are already in hand to erect and furnish a suitable home for the school, which will be ready for occupation in October. To place the enterprise in a position to attain the greatest possible usefulness, an endowment of at least a hundred thousand dollars ought to be secured. Plenty of work lies before the school. Prof. Martin L. D'Ooge of the University of Michigan, the director for 1886–87, writes that the French government is not likely to accept the offer, made by the Greek authorities, of the privilege of making excavations at Delphi, and in that event the chance will be offered to the Americans.

We may fitly end this brief account of the American school at Athens with the glowing words of Professor Goodwin himself upon this very subject: "The Archeological society of Athens has disclosed a wealth of ancient temples near Epidaurus, — among others, the beautiful round building erected by Polycletus, and the theatre, also his work; and the same society has opened to the day the foundations and the pavement of the great sanctuary of Eleusis. the home of the Eleusinian mysteries, which offers more problems to architects and archeologists than will soon be answered. Every part of Greece is full of plans for new excavations, which merely need money to be carried out with substantial results. The ruins of Delphi, with their countless buried temples, which peer imploringly from the scanty earth, as if beseeching the traveller to restore them to the light of the sun, lie at this moment waiting only for some power to decide who shall excavate them; and happy will be the scholars who are fortunate enough to be in Greece when the solemn silence of that wonderful valley of Delphi is first broken by the pickaxe and the spade."

JOHN S. WHITE.

## *LONDON LETTER.*

THAT the people of England are at last beginning to realize the immense importance of technical education is evident from two facts, — first, that scarcely a week passes without prominence being given by the press to utterances on the subject by public men; and, second, that pressure is being put on the government to extend such instruction. A few days ago Lord Hartington distributed the prizes at the Polytechnic young men's Christian institute, an organization in the west of London which numbers seven thousand students in technical subjects; and his speech, in which he quoted Professor Huxley, was widely circulated and favorably commented upon. During the present week a very influential deputation was received at the education department, which strongly urged the provision of manual training in all elementary schools, as a preparation for technical instruction later. It was pointed out that a very slight modification of existing organizations would enable this to be done at a small expense. The reply of the government, though sympathetic, was to the effect that parliament had not yet pronounced an opinion on the subject.

On the evening of March 16 a very well arranged and largely attended *conversazione* was held at the Central institution of the city and guilds of London, for the advancement of technical education. Demonstrations were given during the evening by members of the staff, notably by Professor Unwin, F.R.S., with the 100-ton testing-machine. The apparatus and methods of instruction employed were on view in the different laboratories, and interesting exhibits, lent for the occasion, were also displayed. Two concerts added to the enjoyment of the fifteen hundred guests; but it was rather unkind to allot, as a ladies' cloak-room, a room on the door of which was inscribed, 'Chemical preparation room.'

Lecturing a few nights ago to a crowded audience at the Royal institution, on 'Mental differences in men and women,' Dr. Romanes remarked that the average woman's brain weighed five ounces less than the average man's, and that the inferiority of women displayed itself in the absence of originality in the higher levels of intellectual work. In powers of acquisition, women stood nearer to men, and indeed often surpassed them at an early age.

On Tuesday, March 15, a most unusual meteorological state of things prevailed in London, which was at the time under the influence of the calm weather between two systems of depression. Snow fell to the depth of a foot or more, — and it did not disappear for more than a week, — and simultaneously a high fog occurred, literally causing midnight at noon and for some hours after, although the lower strata of air were fairly clear, and devoid of mist. In consequence of the unexpected sudden consumption of gas, the supply thereof ran short, and in many places grave inconvenience and danger resulted.

M. Hermite's process of the electrolytic bleach-

ing of cotton cloth, etc., is attracting a great deal of attention from both the scientific and the practical side. A very favorable opinion was lately expressed upon it at the Society of chemical industry. The process consists essentially in electrolyzing a solution of magnesium chloride, thus liberating the active agent of chlorinated lime; and, as it is easy to maintain the solution at constant strength, it is found that the consumption of chlorine is only one-half that on the ordinary system. The fundamental industrial equation of economy shows that the mechanical work represented by 570-horse power spent upon a dynamo-machine will produce the equivalent of ten hundredweight of bleaching-powder ('chloride of lime') per hour, or a 50-horse-power engine would give one ton per day of twenty-four hours.

Since Mr. Castner's paper upon his process for manufacturing sodium and potassium was read at the Franklin institute of Philadelphia (Oct. 12, 1886), several changes have been made in the method of manufacture. These were recently brought before the London section of the Society of chemical industry by Mr. James Maclear. With caustic soda at eleven pounds per ton, the sodium produced costs less than twenty-five cents per pound, the cost of materials and fuel being only seventeen cents. The steel crucibles employed have been used fifty, and probably can be used a hundred and fifty or two hundred times: hence the 'tear and wear' on them amounts to not more than two cents per pound of sodium. Cheap sodium, it need scarcely be mentioned, means cheap aluminium (by Deville's process), which, with sodium at the above price, can probably be produced at four dollars per pound, or one-fourth its present value.

The conditions affecting the distribution of micro-organisms in the atmosphere were the subject of a paper at the Society of arts three nights ago, by Dr. Percy F. Frankland, son of the distinguished chemist. The method of observation was Hesse's, in which a given volume — usually ten litres — of air is slowly drawn through short wide tubes coated internally with a solid layer of sterile gelatine-peptone. The maximum number in the same place observed through the year, occurred early in August. Elevation above ground, and distance from human habitations, decreased the number. In sea-air, for example, at one hundred and twenty miles from land, there was only one organism to ninety-three litres. In considering his paper, the author expressed a decided opinion that it was the chemical side of bacteriology which imperatively demanded attention at present. The chairman, Prof. Burdon Sanderson, adjourned the discussion for a week, when it will be opened by Dr. Alfred Carpenter.

The government, which was recently approached on the subject, has just agreed to make an annual allowance of eight thousand dollars per year to the youngest of English universities, the Victoria, whose headquarters are at Owens college, Manchester. The success of this application will encourage the promoters of government aid to the university colleges throughout the country, now languishing for want of funds.

The Institution of naval architects, and the scientific ship-building industry generally, have just sustained a severe loss by the death of Mr. William Denny of Dumbarton. Throughout his too brief career, the influence upon him of Mr. William Froude, F.R.S., was very marked. The scientific department which he established in his own yard at Dumbarton, on the Clyde, was the first of its kind in a private ship-building yard, and the façade of its great experimental tank (300 feet by 22 feet, with 9 feet of water) was erected to Mr. Froude's memory. Mr. Denny was the first to use mild steel for the construction of transatlantic steamers, in 1879. His most famous paper probably was that on the difficulties of speed calculation, in 1874–75, and his last was in 1884, on 'Cross-curves of stability.' In 1882 he delivered the 'Watt anniversary lecture' at Greenock, on 'The speed and carrying of screw steamers.' W.

London, March 26.

## GEOGRAPHICAL NOTES.

### Asia.

The latest letters of the enterprising Frenchmen MM. Capus and Bonvalot, who are trying to reach India from Samarkand, are of considerable interest. The latest are dated Jan. 13 and Feb. 23, 1887. They started from Samarkand for Bokhara on Sept. 13. Near Samarkand they traversed the extensive plantations of General Korolkof, who has, by irrigation, brought under cultivation an extensive area of barren country on both sides of the Kara Tepe. Over the difficult passes of Takhta-Karacha and Lahore Murda the travellers reached the valley of the Sangardak. All this district is inhabited by the Uzbegs and Tajiks. After a few days they reached the plain of Hissar. This district produces rice in great quantities and of exceptionally good quality. The town is very unhealthy, and in summer the whole population moves to Karatagh. The travellers then descended the unexplored valley of the Kafirnahan to its confluence with the Amu-Darya. In this valley,

which is everywhere covered with an efflorescence of salt, there are many settlements of the Uzbegs, which are situated on the rich alluvial ground at the bends of the river or on its islands. They followed the Amu-Darya, and, after having made some excavations at Termez, crossed it at Chushka Guzar into Afghanistan. Here they were made prisoners, and, after being detained for twenty-five days, sent back across the frontier. They resolved to return to France, but, on learning that caravans starting from Kashgar go sometimes in winter to Ladak or Le, they decided to take this route. They intend to cross the Pamir, starting from Gulcha. After having reached the Kara-Kul, they will follow the river Akbaïtal, and endeavor to reach Kunjut. Though the passage of these deserts — which are at an elevation of from thirteen to sixteen thousand feet — in winter is very difficult, they will at this season avoid being hindered in their progress by the inhabitants.

### *Africa.*

Rev. George Grenfell, the successful explorer of the Kongo basin, has ascended the Kwango in the Baptist missionary steamer Peace, and reached Kikunji Falls, the place where von Mechow, who came from the south, was obliged to turn back. About six miles from the junction of the Kasai with the Kwango he found another large tributary, the Juma, entering the river from the east, which presented so large a volume of water that it was a matter of uncertainty which was the larger stream. Probably this river is identical with the Kuilu of the maps. He ascended the great bend of the Kwango, which comes back to its northerly course at latitude 4° 30′ south. The Kikunji Falls are about three feet high, and, though insurmountable for the Peace, are said by Mr. Grenfell to be no obstacle to communication by canoes and small craft (*Proc. Roy. geogr. soc.*, April, 1887).

The last number of the *Antananarivo annual and Madagascar magazine* (Christmas, 1886) consists, besides a reprint of Mr. A. R. Wallace's chapter on the fauna of Madagascar, mainly of papers on linguistic topics and on Malagasy folk-lore. M. Grandidier's paper on the channels and lagoons of the east coast of the island is translated, with some interesting remarks by Mr. Sibree appended. Mr. Sibree points out that it would only require about thirty miles of canals to connect all these lagoons, and so create a safe and extensive internal water-way of the greatest commercial value. The Rev. W. Montgomery contributes a paper on the Malagasy game of 'fanerana,' in many respects resembling chess (*Nature*, March 24).

### *America.*

The field-work of the geological survey of Newfoundland in the year 1886 included a survey of the Bay of Exploits, which was made by James P. Howley. Of late years the services of the survey have been devoted chiefly to blocking off land for agricultural purposes. Most of its geographical work is still in manuscript, and has never been published at all. It includes surveys of Notre Dame, St. George's, and Port a Port bays, surveys of all the principal rivers of the islands, and triangulations of the larger lakes.

Fontana has published a report on his expedition in eastern Patagonia. Soon after his appointment as governor of the territory of Chubut, the Welsh colony in the lower valley of the Chubut River, invited by reports of the fertility and gold-mines of the Andes, organized an expedition for exploring the valleys of the Andes, and offered the leadership to Fontana. The party ascended the river Chubut, which flows through the desolate plains of eastern Patagonia. As its upper course runs almost parallel with the Andes, they ascended the Charmate, one of its tributaries, and then struck west. After a ride of a few days they reached the fertile valleys of the Andes, and came to the Rio Corcovado, which runs west to the Pacific Ocean. As the confluence of the Chubut and Charmate is only 1,800 feet above sea-level, and the point where they reached the valley of the Corcovado 1,600 feet, it is evident that the Andes do not form a continuous chain of mountains, but that they are intersected by deep valleys. Farther south the Strait of Magellan, the Rio Santa Cruz, Rio de los Huemules, and Rio Aysen indicate valleys that cut across the whole width of the mountains. As the land was so heavily timbered as to hinder the progress of the party, they returned to the Charmate. From here they went south, and passed the watershed between the Senguel and the Chubut. After having reached the Senguel, they ascended it, and it is here that Fontana made his most important discovery. In latitude 45° south, close to the source of the Rio Aysen, he found a large lake, through which the Senguel flows. He was prevented from following its upper course, as the woods were too dense. He therefore returned, following the Senguel, which flows through a swampy valley, bordered on its southern side by desolate hills, on its northern side by volcanic mountains, the colors of which are as manifold and glaring as those of the Painted Desert. This expedition will probably lead to the establishment of a colony on the Corcovado, or Lake Fontana, as the newly discovered lake has been called, by the enterprising Welsh

colony of the lower Chubut (*Deutsche geogr. Blätt.*, 1887, No. 1).

*Australasia.*

Admiral von Schleinitz, governor of the German possessions in New Guinea, is continuing his explorations on the coasts of New Guinea and the neighboring islands. In October, 1886, he explored the coasts of Huon Gulf, where he found several navigable rivers. The coast consists of archaic and metamorphic rocks. In November the coast from Iris Point to Cape della Torre was surveyed. The results of these observations have been published in the *Nachrichten aus Kaiser-Wilhelm-Land und dem Bismarck Archipel*, 1887, Nos. 1 and 2.

Mr. Vogan, the curator of the Auckland museum, intends to cross south-eastern New Guinea from Freshwater Bay to Huon Gulf as soon as the rainy season is over (*Proc. Roy. geogr. soc.*, April, 1887).

*Oceans.*

The methods and results of Lieut. J. E. Pillsbury's researches on deep-sea currents in the Straits of Florida (Appendix 14, *Coast and geod. surv. report for* 1885) are very interesting. They were carried out on the steamer Blake, at five stations between Gun Key and Cape Florida. By an ingenious arrangement, Pillsbury contrived to anchor at a depth of almost five hundred fathoms, and was thus enabled to measure the currents by a revolving meter. For a description of the apparatus we refer to the original paper. As the time allotted to the work was not long enough to make exhaustive researches, and the state of the weather was frequently too bad for anchoring in deep water, the observations are rather irregular. The results are very valuable, and we are glad to learn that the researches will be continued. The strength of the current is influenced by the tides; and the principal maximum, which occurs about four hours before the meridian passage of the moon, is very distinct. The fluctuations of the curve are so irregular, however, that it is hardly possible to plot the observations for determining the axis of the current and its strength in various depths. It appears that the greatest intensity of the surface current is near the west shore, while the current at a depth of a hundred and thirty fathoms is strongest in the middle of the strait.

Lieut. A. de Gueydon has constructed an apparatus similar to that used by Lieutenant Pillsbury, but far more complicated, which he has tested by measuring the currents of the Bosporus. It is described in the *Revue maritime et coloniale*, November, 1886. The results of his observations confirm those obtained by Makarof (*vide Science*, ix. 301). He found during calms and prevailing north-easterly winds a surface current of ninety feet depth setting from the Black Sea to the Sea of Marmora. At Constantinople a smaller arm branches off, which sweeps along the south side of the Golden Horn, and forms an eddy, returning on the north side, and again reaching the Bosporus at Top Hane. This current reaches to the bottom. Sudden changes in its velocity are very frequent. Under the main surface current, Gueydon found the well-known undercurrent running from the Sea of Marmora to the Black Sea.

In the *Annalen der Hydrographie*, 1887, No. 3, G. Karsten discusses the observations on the ice of the harbor of Kiel, the most important station of the German marine in the Baltic. During the thirty-eight years over which the observations extend, the harbor was frozen up seventeen times, the mean duration of the ice-sheet being thirty-four days; the maximum, seventy-one days. The ice forms most frequently in January. In the beginning of winter the warm concentrated water of the German Ocean, which enters the Baltic, delays the formation of ice, though the temperature of the air may be low. As soon as an easterly wind sets in and carries less concentrated cold water of the Baltic into the bay, an ice-sheet is formed.

*General.*

The publication of the *Zeitschrift für wissenschaftliche Geographie*, which was discontinued some time ago, has been resumed by Dr. J. I. Kettler. The first number for 1887 contains, among other papers, an article by O. Krümmel on surface temperatures of the ocean, and one by H. Reiter on the Antarctic question.

## NOTES AND NEWS.

THE chemist of the Massachusetts state board of health has recently analyzed a large number of so-called temperance-drinks, and has found that all of them contain alcohol, one of them containing as much as 44.3 per cent. Several of them contain more than 40 per cent, and a very large proportion more than 20 per cent. One of these is said by its manufacturer to be "a purely vegetable extract, stimulus to the body without intoxicating." "Inebriates struggling to reform will find its tonic and sustaining influence on the nervous system a great help to their efforts." This preparation was found to contain 41.6 per cent of alcohol.

— The Boston *Medical and surgical journal* contains the history of six cases of poisoning from the arsenical wall-paper of a single room, extend-

ing over a period of several years. The removal of the paper was followed by perfect immunity to those who subsequently occupied the room.

— A. H. Smythe, Columbus, O., announces an edition of the 'Preliminary report on petroleum and inflammable gas in Ohio, by Prof. Edward Orton, state geologist. The first edition was issued and distributed by the legislature of Ohio, and no copies were placed on sale.

— Professor Rhys-Davids is at work upon a selection of sacred Pali texts which he expects to publish shortly.

— The English Goethe society now numbers two hundred and fifty members, and has undertaken the publication of its Transactions.

— The *Athenaeum* finds, that, according to the most recent reports, education in the north-western provinces of India amongst males has received a slight check, the number of pupils at the schools having decreased from 249,355 to 244,146. On the other hand, female pupils increased from 10,746 to 11,187. Altogether, 94 boys and 4 girls per thousand of the population of school-going age are under instruction. It is a sign of the very satisfactory progress now being made by Mohammedans in educational matters, that, in proportion to their numbers, they contribute four times as many pupils to the primary schools, and nearly twice as many to the secondary schools, as Hindus.

— No school and college text-books are as handsomely gotten up as those issued by Macmillan & Co., and we are glad that they offer the product of their press to students of mathematics as well as to students of literature. We have recently received their 'Text-book of Euclid's elements, books i and ii.,' by Messrs. Hall and Stevens. The little book is handsomely printed, the original riders and deductions clear and useful, and the use of type in the various demonstrations very judicious. We like especially the way in which the given lines and lines of construction are distinguished in the diagrams. It is a great improvement upon the old-fashioned use of the dotted line.

— A performance of the *Oedipus Tyrannus* is to be given at Cambridge, England, in November next.

— The Rede lecturer at the University of Cambridge for the coming year is J. R. Seeley, regius professor of modern history.

— There were no fewer than 3,635 matriculated students at Edinburgh university last year, which is the largest number on record. Of these, 1,915 were students of medicine; 1,122, of arts; 490, of law; and 108, of divinity. Of the medical students, only forty per cent are Scotchmen.

— St. Andrews university has conferred a large number of honorary degrees recently. Dr. Philip Schaff of the Union theological seminary, New York City, was among those who received the degree of D.D.

— We have received the biennial report of the State school of mines at Golden, Col. It is well gotten up, and contains as an appendix valuable papers by members of the faculty, as follows: 'Notes on iron prospects in northern Colorado,' Regis Chauvenet; 'Mineral resources of Boulder county,' P. H. van Diest; 'Geology of the Aspen mining district,' Arthur Lakes; 'The present mining-law chaos,' Magnus C. Ihlseng; 'Mining notes from Eagle county,' George C. Tilden.

— The 'Elements of English,' by G. H. Reker (Chicago, Interstate publishing co.), is an introduction to English grammar for the use of schools. It is very elementary in character, and consists of a series of lessons treating of the parts of speech and their uses, of the simple sentence in its various forms, fully illustrated by practical exercises composed of common words in daily use, so that pupils are gradually, and almost unconsciously, led on to a knowledge of the correct use of their own language.

— Mr. A. M. Ogilvie recently presented before the Aristotelian society an interesting paper on Lotze's metaphysics, of which the following is an abstract. The most significant aspect of Lotze's teaching is its many-sidedness. An eminent man of science as well as a philosopher, he also had a most delicate appreciation of the aesthetic and moral standards of value which govern human life. He sought in philosophy an answer to the complex of questions arising out of life as a whole, and not merely an hypothesis satisfying the requirements of physical science. No one felt more strongly that only in actual experience have men a living evidence of reality, but he showed that in experience the significance lies in those ideal forms in which it manifests itself to reason. In his ultimate analysis of our experience of nature, Lotze arrived at a conception of a universal absolute working by fixed laws, revealed to us in experience, towards an ideal end. Mental phenomena in the same final analysis give evidence of the existence of finite spirits, not independent of the Infinite Spirit, which in the last resort the aesthetic and moral experience of man realizes not merely as a bare absolute, but as a living personal Deity.

— Sir William Vernon Harcourt has resigned

the professorship of international law at Cambridge.

— Dr. Hall's lectures on education at the Johns Hopkins university are given once weekly before a class of twenty-nine students.

— In the current number of *Scribner's magazine* are two articles that may fairly be classed as educational. The first is by Prof. W. B. Scott of Princeton, on 'American elephant myths,' in which he discusses in an extremely interesting manner the evidence, in tradition and inscription, of the existence of elephants in America in ancient times, and recounts many of the popular fallacies in regard to them. Prof. A. S. Hill of Harvard closes the number with a short but vigorous article on 'English in our colleges,' in which he discusses the question of what branches of English instruction are of greatest importance to college students, and pays particular attention to the methods of teaching English composition.

— Archdeacon Farrar writes from East Africa that the whole district of Magila, with its hundreds of villages and thousands of people, has recently been saved an invasion of small-pox, which has prevailed in surrounding districts, by general vaccination. He adds that this has commended medical science to the people, and they come in numbers to be vaccinated.

— Dr. Gustav Berndt has prepared a monograph on the Swiss Foehn, entitled "Der Foehn, Ein Beitrag zur orographischen Meteorologie und comparativen Klimatologie" (Göttingen, 1886). This is the most considerable work of the kind; and, although devoted especially to the phenomena noted in Switzerland, it has also an introductory chapter giving the history of the theories proposed to account for this wind, and a final chapter describing analogous winds elsewhere. The latter does not include any on this continent, if Greenland be excepted.

— Dr. Davenport, state analyst of Massachusetts, has examined twenty advertised cures for the opium-habit, and found that all but one contained opium. This one was called 'double chloride of gold,' but contained no trace of gold.

— Superintendent Barringer's last report shows that the number of children in Newark (N.J.) of school age — between five and eighteen — is 42,263, an increase over the previous year of 454. 41 school-buildings are in use; and 380 teachers, of whom only 29 are males, are employed. The total enrolment was 24,894, and the average per cent of attendance, 89.2.

— Lord Gifford, one of the judges of the Edinburgh court of session, who died recently, has bequeathed £80,000 to found lectureships on natural theology at the four Scottish universities. Edinburgh gets £25,000; Glasgow and Aberdeen, £20,000 each; and St. Andrews, £15,000.

— The *Athenaeum* states that the report on education in the Bombay presidency for the year 1885–86, recently issued, is of unusual interest as dealing with the important subjects of the transfer of schools to local bodies, and the development of technical education. With regard to the general progress of education, the year's statistics are the most favorable ever presented to the government of Bombay. At the end of the year there were 460,987 children in the schools connected with the education department, the largest number previously recorded having been 438,416. One specially favorable feature of the report is the evidence it supplies of the progress of female education, the number of girl pupils at the schools having increased from 42,230 to 45,037. The government consider that the report affords ample proof of the capacity of private enterprise in respect of the management of higher aided schools.

— The *Medical and surgical reporter* records the observations of Gellé in the relation between sensibility of the tympanum and the direction from which sound comes. When a sound strikes the ear, it is referred to that part of the horizon towards which the organ is directed at the moment of the most intense sensation. The knowledge of the fact that the sound-producing body is outside us, and the notion of the direction in which it lies, are thus acquired at one and the same time. How is the result obtained? As a result of experiments on two patients in Charcot's wards, Gellé concludes that the sensibility of the tympanum plays an important part in the effort to perceive the direction of sound; that the tympanum is sensitive to the vibrating sound-waves, and this sensibility gives us the notion of exteriority and of the direction of the sound. The patients were suffering with general anaesthesia, and it was found that the drum-membrane might be touched and pricked without the patient's having the least sensation of pain or of contact. Although the tick of a watch could be heard with either ear, the patients were unable to say on which side it was placed.

— Mr. George J. Romanes has communicated to the Linnean society the results of some experiments made by him to test the sense of smell in dogs. He finds that not only the feet, but the whole body, of a man exhales a peculiar odor which a dog can recognize as that of his master amidst a crowd of other persons; that the individual quality of this odor can be recognized at great

distances to windward, or in calm weather at great distances in any direction; and that even powerful perfume may not overcome this odor. Yet a single sheet of brown paper, when stepped upon instead of the ground, and afterward removed, was sufficient to prevent his dog from following his trail.

— Some of the features of shorthand-writing, synchronous-multiplex telegraphy, and type-writing, are combined in a system of steno-telegraphy invented by M. G. A. Cassagnes of Paris. In recent experiments over a wire running from Paris to Orleans and back, messages were sent at the rate of two hundred words a minute, that being the highest speed attainable by a nimble-fingered operator. By means of an automatic transmitting apparatus, using a strip of paper previously perforated, as in some of the systems of telegraphy already in vogue, seventeen thousand words per hour were sent over a line 650 kilometres in length, the messages being automatically printed by the receiving instrument.

— The general assembly of German teachers will be held this year at Gotha on May 31 and June 1 and 2.

— The German teachers of modern languages, having doubtless seen how successfully a similar scheme is working in France, asked the chancellor to establish travelling scholarships for advanced students of modern languages. Bismarck replied that the matter was not one for the imperial government to attend to, but should be brought before the educational authorities of the various German states.

— The gymnasial curriculum in Hungary, having proved faulty, is to be altered. A commission appointed to devise means of improvement recommend that Hungarian literature, at present confined to the highest class, be taught in the two highest classes; the teaching of geography, hitherto restricted to the lowest classes, to be carried higher up and preceded by a course of political geography; German to be taught less theoretically, and more with a view to acquiring the language practically. The teachers in the gymnasia are recommended to raise the standard of their teaching, and not to allow the pupils to go into a higher class so easily as at present. This evil prevails chiefly in the confessional schools, where the teachers draw part of their salary from the school fees. The government is recommended, in the report, to alter this system of payment.

— A dinner in behalf of the American school of classical studies at Athens was given April 14 at the Hotel Brunswick. The object of this dinner was to afford to the founders of the school an opportunity of bringing its purposes and methods conspicuously before the public, and to quicken the interest of many who now know of it only by repute.

— The excursion committee of the Appalachian mountain club present the following preliminary announcement, subject to possible changes: April 30, Monk's Hill, Kingston; May 14, May walk, Wissahissick Pond; May 28-30, Mount Grace (Warwick), and Greenfield, Mass.; June 17 and 18, Monadnock and Dublin, N.H.; July 1-9, Crawford House; Aug. 20-30, Ktaadn.

— The following schedule gives the location of the vessels in the coast-survey service and a brief summary of their work: the steamer Gedney (F. H. Crosby commanding) and the schooner Eagre (C. P. Perkins commanding) have begun work in Long Island Sound, and will make an extended and systematic series of current observations in the waters of the sound; the steamer Bache, in command of Lieut. J. F. Moser, is at work on the coast of Florida; the Endeavor, in charge of Lieut. D. D. V. Stuart, is now engaged on current observations off the coast of Louisiana; the Blake, in command of Lieut. J. E. Pillsbury, U.S.N., is taking deep-sea soundings in the Gulf Stream; the Patterson is now at Mare Island navy-yard, California, and will probably start for the working-grounds in south-east Alaska, about the first of May, in command of Lieut.-Com. Charles M. Thomas, who relieves Lieut.-Com. A. S. Snow; the steamer McArthur is at Oakland, Cal., in command of Lieut. J. C. Burnett, preparing for work on the coast of Oregon and Washington Territory; the schooner Earnest, in command of Lieut. Charles T. Forse, is fitting out for work in Puget Sound, Washington Territory.

— U.S. Consul Goodwin of Annaberg, Germany, in a recent report on oyster-culture in Germany, states that the experiments of transporting and breeding American oysters have proved quite unsuccessful in all cases, and entirely so in most instances. Professor Möbius of the University of Kiel, who has made many experiments, expresses the opinion that American oysters would never spawn in German waters. Mr. Fedenser, a citizen of Schleswig, who takes great interest in the subject of oyster-culture, however, has not abandoned the attempt. He is of the opinion that American oysters can be successfully raised in Germany, and he has planted two hundred and fifty barrels of selected breed oysters in the vicinity of Schleimünde.

— Nebraska has just come into the line of states distinguished by having state boards of health.

—It is intended to hold an international congress on cremation in September of the present year in Milan.

—Mr. Thomas Wilson of Washington has just presented to the national museum a fine collection of old coins, chiefly Roman, which will shortly be placed on exhibition. In the collection is a Swedish daler coined in 1736. It is an oblong plate of copper, about four inches long and three inches wide, with four circular die-marks stamped upon it. The coin weighs about a pound and a half. The collection of Roman coins starts with a simple lump of bronze, the *aes rude*, which served as a medium of exchange among the Romans seven hundred years before the Christian era. This was obtained at Palustrina. There are numerous rudely stamped coins of a later day, consular coins of the republic, and later specimens of coins of imperial Rome. These are stamped with the heads or busts of the reigning emperor. The coins are of gold, silver, and bronze. A curious specimen of the collection is a counterfeit coin made by some Roman rogue. It is a copper coin washed with silver.

—It is said that there were in Norway, in 1879, 1,630 cases of leprosy, some five hundred less than in 1856; so that the disease appears to be on the decline. By a recent law the government is empowered to send all lepers to the hospitals, but this power has not yet been exercised.

—The address of Prof. Andrew F. West of Princeton college, on 'How to improve our classical training,' delivered last fall in Philadelphia, has been printed in pamphlet form in response to the request of a number of classical teachers.

—Belgium's recent educational changes show at least one decided departure from German practice. The final examinations of the gymnasia have been abolished, and a matriculation examination at the university substituted for them.

—Professor Kirchhoff's abridged grammar of Volapük, the new universal language, has been adapted to the use of English-speaking people by Karl Dornbusch. This language has been formed after twenty years' laborious research by M. Schleyer of Constance. He has named it Volapük from *pük* ('language') and *vol* ('universe'). It has no artificial genders, a single conjugation, and no irregular verbs. The roots of its words have been borrowed from all the languages of Europe. The adjective, verb, and adverb are regularly formed from the substantive, and have invariably the same termination.

—One of the most important collections of oriental manuscripts ever brought to Europe is the collection which belonged until recently to King Theebaw of Burma, which had been handed down to him as an heirloom by his ancestors or predecessors, and which has now been placed, probably for many centuries to come, on the shelves of the library of the India office in London.

—Lectures on geography are now being delivered at Cambridge university by gentlemen appointed by the Royal geographical society. The university lecturer on that subject assumes his office in 1888, and the contribution of the university toward his salary is only fifty pounds.

—Mr. Gladstone has contributed to the April number of the *English historical review* an article on the last part of the 'Greville memoirs,' which will be of documentary interest for the history of the years 1852 to 1860.

—Prof. William G. Peck of the chair of mathematics and astronomy in Columbia college, whose excellent series of mathematical text-books are in such general use, has recently added to his list a little work on 'Determinants' (A. S. Barnes & Co., New York). The book gives in forty-seven well-printed pages just such an easy introduction to the subject as the beginner wishes to have. The examples are abundant, and the text clear and accurate.

—The *Central-Organ für die Interessen des Realschulwesens* prints on its titlepage, "Die Realschule ist die Schule der Zukunft, weil sie die deutsche Schule ist." The same journal has for its motto,

> "Der Schule zu Ehren
> Die Freunde vermehren,
> Die Zweifler belehren,
> Die Gegner bekehren
> Ist unser Begehren."

—Prof. Friedrich Koldewey is editing a work of great educational interest, entitled 'Monumenta Germaniae pedagogica.' The first volume has already appeared: it contains the 'Braunschweigischen schulordnungen' from the earliest times until 1828.

—Prof. S. S. Laurie, who occupies the chair of pedagogics at the University of Edinburgh, is about to receive the degree of LL.D. from St. Andrews university.

—Dr. Gobat, the head of the education department of Switzerland, is about to introduce some radical reforms. He criticises the present code as having no sound psychological basis. He says that it makes the development of the mind conform to it, instead of itself conforming to the development of the mind. He finds that the reason the classics are losing interest is that they are poorly taught.

— Much progress is being made in Scotland toward the development of a university extension scheme similar to that described in a recent number of *Science* by Mr. Oscar Browning.

— On account of failing health, Professor Tyndall has resigned his position at the Royal institution.

— The article on the French lycée, which appeared in this journal for Feb. 18, was, by an oversight, not credited to the *Canada educational monthly*, as it should have been.

## *LETTERS TO THE EDITOR.*

**** The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The rudimentary metacarpals of bison.

IN *Science* for Feb. 18 Dr. D. D. Slade notes the fact that the skeleton of aurochs in the Museum of comparative zoölogy has rudiments of the second metacarpals, while the rudimentary fifth metacarpals are wanting. Dr. Slade will, I trust, pardon me for saying that the deduction he would make from this fact is not quite clear to me. If he considers it an *individual* peculiarity, I heartily agree with him; but, if he concludes from the evidence presented by this one skeleton that the arrangement of the rudimentary metacarpals in Bison bonasus differs from that of Bison americanus, I desire to protest most emphatically against any such inference.

Just now, by the efforts of Mr. Hornaday, the U. S. national museum has provided itself with a goodly number of skeletons of Bison americanus. Examination of four or five of these shows that in every case rudiments of the second and fifth metacarpals are present, the second being always the smaller of the two pairs. As these are all *in situ*, there can be no mistake in the matter. Our mounted skeleton of Bison americanus has only the fifth metacarpal present, but this is because the others have (or at least one of them has) been lost. There is a well-defined articular facet present for the second right metacarpal, but none for the left, although this may none the less once have been present.

The skeleton of aurochs in the national museum has, as Dr. Slade notices, the second and fifth metacarpals present. That, as now mounted, the inner metacarpal on one leg is larger than the outer, proves nothing, as a transposition may readily have been made by the preparator; and no one knows better than the writer how easily such a mistake may be made.

Until a far greater number of skeletons of aurochs have been examined, it would seem the safer course to assume that Bison bonasus, in the matter of its metacarpals, makes no departure from the usual order of things found in the Bovinae, and that the Cambridge specimen is merely a case of individual variation.

FREDERIC A. LUCAS.

Washington, D.C., April 10.

### The Bellville meteor.

Messrs. A. S. Barnes & Co., publishers of school text-books, have just received the following letter, which is copied *verbatim et literatim*, and published for the public good: —

"April 1 1887
"Bellville ohio
"Gents sir to you

We read & hear a great deal of Meteors what thay are i went To see one that fell last fall In november i saw it the papers That it is found hundreds of People went to see it is a curiosty Thair is no print yet discribed Its facts yet as when you see it With the naket eye that some Astronomy aught to have it For the benifit for his books It is a curious stone it is the oddes Shaped stone that ever was by man Or all that i talked with that seen it i asked Mr Phiel how Far him & his son was from it When it fell he told me about 4 rods he says it made The earth shake and a Trementous scmel of sulpher It shocked him he went to Worke and dug it out and Took it town it raised the Accitement a greate many people Told me that thay would paid him 50 cts for to see but he left it Public for all to see it some said he aught to travil with It and put on exbition but He says that dont suit for he haint got gab enough for That business that will do some One ells he says if he can find out .P. T. Barnums address he Is going to rite to him and Try to sell it to him and Take it with his show for he can make money with it i asked him what he would Take for it he said he might take betwen 2 or 3 hundred dollars Mr Barns That would suit you in your Great store if you Gents would Have that meteors in your store Thair would thousands of people Would stop and see it and Pay 25 or 50 cts to se it i Must clos for it is almost Train time for i going to Kanses if you want to rite about the meteor or get some one ells Address

A. B. Phiel,
Bellville Richland
County ohio

"For he will give the full Particulars of it
"Yours Truly from
WM. H. BEAM."

### A sensitive wind-vane.

The importance of the sensitive wind-vane question may justify still further trespass upon the space which you allot to correspondence. I am obliged to Mr. Curtis for calling my attention to Mr. Osborne's sensitive vane, as I did not know of it before.

On reading Mr. Osborne's paper, however, I find that his plan was essentially different from mine, in that he applied a liquid damper to the registering-apparatus, and not to the vane itself. In my opinion, there is a decided advantage in controlling the motion of the vane. If it be allowed an unrestricted motion, as is generally the case at present, the influence of its false movements and positions must be felt in some degree by the registering-apparatus, even when that is damped as suggested by Mr. Osborne. The direct damping of the vane will be cheaper and less complicated. As to the length of the vane, I believe that a vane controlled in this way need not be over five feet in length. A vane is often subjected to severe vertical strains, and it should be proportioned so as to endure these without danger. Mr. H. Helm Clayton seems to have entirely misunderstood the question under considera-

tion, which concerns the vane itself, and not the registration of its movements; and in justice to the signal office it ought to be said that a method of registration precisely similar to Dr. Draper's has been in use for many years. Indeed, it is through the study of the records made by this method that the imperfections of the vane are made to appear.

T. C. M.

Terre Haute, April 11.

### The power of a voter.

In the general election of 1884 the total number of votes cast in the country was 10,048,061. The number of senators is 76, and the number of representatives is 325. With these numbers, and the total vote of each state in this election, the following table has been computed, in which the figures of the columns give the relative power of votes in the different states: —

| | Senatorial power. | Representative power. | Presidential power. |
|---|---|---|---|
| Alabama | 86 | 52 | 65 |
| Arkansas | 105 | 40 | 56 |
| California | 68 | 31 | 41 |
| Colorado | 199 | 15 | 45 |
| Connecticut | 96 | 29 | 44 |
| Delaware | 439 | 33 | 100 |
| Florida | 221 | 33 | 67 |
| Georgia | 92 | 70 | 84 |
| Illinois | 20 | 30 | 33 |
| Indiana | 27 | 26 | 30 |
| Iowa | 35 | 29 | 35 |
| Kansas | 50 | 26 | 34 |
| Kentucky | 48 | 40 | 47 |
| Louisiana | 121 | 55 | 73 |
| Maine | 102 | 31 | 46 |
| Maryland | 71 | 32 | 43 |
| Massachusetts | 44 | 40 | 46 |
| Michigan | 33 | 27 | 32 |
| Minnesota | 70 | 26 | 37 |
| Mississippi | 110 | 58 | 75 |
| Missouri | 30 | 32 | 36 |
| Nebraska | 98 | 22 | 37 |
| Nevada | 1,033 | 78 | 234 |
| New Hampshire | 156 | 24 | 47 |
| New Jersey | 51 | 27 | 34 |
| New York | 11 | 29 | 31 |
| North Carolina | 49 | 34 | 41 |
| Ohio | 17 | 27 | 29 |
| Oregon | 251 | 19 | 57 |
| Pennsylvania | 15 | 30 | 32 |
| Rhode Island | 403 | 61 | 122 |
| South Carolina | 144 | 76 | 98 |
| Tennessee | 51 | 38 | 46 |
| Texas | 41 | 34 | 40 |
| Vermont | 223 | 31 | 67 |
| Virginia | 46 | 35 | 42 |
| West Virginia | 100 | 30 | 45 |
| Wisconsin | 41 | 28 | 34 |

In many of the states the conditions are such that a full vote is rarely polled. The smallest percentage of voters to males over twenty-one years was in Rhode Island, where it was less than 43 per cent. In Massachusetts and Mississippi the percentage was about 60. In Florida it was more than 90 per cent. Notwithstanding this defect, the table shows very well how political power is distributed among the voters with respect to the legislative and executive branches of the general government. It will be seen that the distribution of this power is much more uniform in the house of representatives, as was intended; and this fact will evidently be a source of power to this house in its conflicts with the other branch of the legislature. On the other hand, the difference of the senatorial power of voters in the states has become very marked. Thus a single voter in the state of Nevada has as much senatorial power as 91 voters in New York; and a voter in Delaware, 39 times as much as one in New York, and 9 times as much as one in Kentucky. The New England states have more than 9 times the power of New York. In addition to this, in some of the states the senators are elected by a minority of the voters. Where political power is so unequally divided, the respect for the legislative body will depend largely on its wisdom, and the fairness of its conduct towards the whole country. But it is doubtful whether such a condition is permanent.

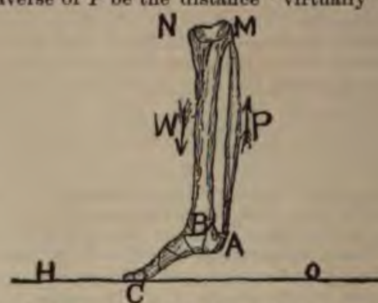
ASAPH HALL.

Washington, April 4.

### On tiptoe.

Allow me to say a few final words. The *fulcrum* of a lever is that axis of rotation with reference to which an equation of moments, *consistent with the principle of work*, can be stated. It is my belief that the ankle is the fulcrum of the foot under the circumstances of the problem before us.

How can Professor LeConte's equation be correct as it stands, $P \times CA = W \times CB + P \times CB$, unless the traverse of $P$ be the distance 'virtually' moved




over by the point $A$ of his figure? I claim to have proved that the traverse of $P$ is *not* that distance, but that the arm of $P$ is $BA$, if the arm of $W$ be $CB$. If the toe *must be* the fulcrum, a proper equation of moments may be stated by regarding the case as of the third order, with power 'virtually' applied at a distance from toe equal to the distance between heel and ankle. On this view, a foot might be constructed which could be regarded as of the second order, by putting ankle nearer to toe than to heel, or an indeterminate case could occur if ankle were midway between toe and heel. Why not proceed as in the case of the Roberval balance, for instance, by tracing the pressures, produced by bodies applied to the system, to the axes of rotation where such pressures become effective as 'power' and 'resistance'?

Finally, I regard the case under discussion as of the first order, because, first, no proper equation of moments seems possible with power at heel and fulcrum at toe; secondly, a 'virtual' axis must be assumed with power at ankle and fulcrum at toe; thirdly, with power at heel and fulcrum at ankle, the conditions are as usual, except that the mutual tendency of the earth and the 'weight' to approach each other — which tendency produces the 'resistance' — is exerted by the earth at the end of the lever and by the weight at the fulcrum, instead of *vice versa*.

F. C. VAN DYCK.

New Brunswick, N.J., April 9.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 15, 1887.

## *WHAT INDUSTRY, IF ANY, CAN PROFITABLY BE INTRODUCED INTO COUNTRY SCHOOLS?*

IF the question proposed for this symposium is to be taken literally, I should answer, none.

Industry, as such, has, in my judgment, no place in the public schools, though industriousness is always in order there. The prime object of our school system is education; and it cannot be to any considerable extent diverted from that end without injury to the schools themselves and to the community at large. Indeed, it would scarcely be possible to do a greater wrong to the major part of our public-school children than by taking any appreciable share of the little time they have for the development and training of their intellectual powers, for the purpose of applying it to the mere means of bread-winning or money-making.

But while I thus hold strongly to the strictly educational character of school-work, I believe that the courses of study in the schools of New England have been, and, though in a diminishing degree, still are, incomplete, and inadequate to the demands of a full and symmetrical education. I believe that these deficiencies have induced a one-sided development of mind and character; have led to the setting-up of false standards of what is admirable and desirable in life; have caused to be magnified glibness of speech, force of declamation, readiness in recitation, and retentiveness of memory, at the expense of far more useful faculties, qualities, or habits, namely, soundness of judgment, clearness of perception, the habit of observation, the creative instinct, the executive faculty.

Briefly speaking, my project of reform, in schools for boys, would be as follows: carry the best approved methods of the kindergarten upward through the primary grades, as far as the means and resources of each school, for itself, will allow; introduce more and more the study of form, color, texture, structure, and organization, by means of natural objects in the hands of pupils and teachers, stimulating and encouraging the pupils, more and more as their faculties are developed, to make observations for themselves at their play or at their work, and to bring the results back to the school-room, for comparison, for criticism, for discussion; at the age of twelve, or thereabouts, introduce semi-weekly exercises with tools, preferably wood-working tools, and in clay-modelling, for the cultivation of the sense of form, for the training of the eye and hand, and for gaining the power to give material shape to conceptions of the mind; at fourteen years of age, or thereabouts, introduce exercises in metal-working, and require every boy who passes through one of the high schools of the state to become a good mechanic, not at all for the sake of his practising a mechanical avocation, but to make him a better-equipped, more capable, and more useful *man*.

All this could not be done at once. The system would have to be introduced gradually and tentatively. Probably the more natural order would be that the system should extend from the higher schools downward, and from the city schools outward. Much would be learned in the course of the gradual development of such a system; and the best conceived programme would doubtless require considerable modifications, as the result of experience.

In the case of girls, somewhat different exercises should be prescribed. They should, of course, share in the extension of kindergarten methods and objective science-teaching. Of all other exercises, sewing and cooking should have preference. Clay-modelling and paper and pasteboard cutting might advantageously replace much of the wood-working required of boys; but it is not at all certain that girls may not advantageously be taught simple carpentry and cabinet-work. The last-named exercises have been introduced with great success into the normal schools at Salem and Bridgewater, Mass., where the young women readily acquire the power of making much of the simple apparatus required for teaching elementary physics and mechanics.

FRANCIS A. WALKER.

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It is doubtful if any industrial feature can be profitably introduced into country schools at the present time.

1. Industrial education is very costly. Under the apprenticeship system, seven of the best years of the life of the youth were given in exchange for the skill that might be imparted, by the master-workman, in a single trade. Still the training of the apprentice was very unscientific Competent and experienced teachers declare that two weeks of systematic instruction in a thoroughly equipped,

well-conducted manual-training school produces as great a degree of dexterity as two years' apprenticeship under the adverse conditions which prevail in the typical trade-shop. The institution that affords such scientific instruction is necessarily expensive. The Chicago manual-training school received an endowment fund of one hundred thousand dollars; but the tuition-fee therein is two hundred and forty dollars, for the course of three years, and yet the institution is not self-sustaining.

2. The necessity for industrial features is far less imperative in country than in city schools. The country boy learns, very early in life, to do a host of things by doing them. He almost invariably finds his way to a shop containing the typical hand-tools, and learns to use them; and through such use his eyes, his hands, and his mind are trained. Ruskin expresses this idea in a terse sentence: "Let the youth once learn to take a straight shaving off a plank, or draw a fine curve without faltering, or lay a brick level in its mortar, and he has learned a multitude of other matters which no lips of man could ever teach him." Every exercise of farm-work in which the youth engages, develops the observation and renders the judgment more accurate. A rainy day in the shop, with the saw, the hammer, the plane, the chisel, and the square, is better than a week of the city boy's school. The experience of the country boy in field, forest, and shop, is the most important factor in his education. It is to these industrial features of his training that he owes his undoubted superiority to the city youth. Too much prominence cannot be given the fact that it is in the country that the race is regenerated. Rousseau's remark, "Cities are the graves that swallow up the human species," is worthy the careful consideration of educationists. The founding of manual-training schools in cities is an effort to give to city children that knowledge of things which is obtained by country children out of school.

It is, hence, impracticable, for the time being, because of its great cost, to add industrial training to the curriculum of the country schools; and it is unnecessary to do so, since a thousand *things* are learned for nothing by the country boy, through the daily exercises of labor and play, which can be mastered by the city youth only in special schools established and conducted at large cost.

CHARLES H. HAM.

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The meaning and application of the term 'school education' is broadening year by year; not in the sense of increasing the number of the subjects of knowledge for the young people to study, but in discriminating with a view to lessening them, thereby providing the means for a better, more natural growth of the mental and physical powers. The limit of this abuse of the privileges of school, by compelling an excessive use of the brain, we believe is reached; and the best teachers all over the state and country are seeking earnestly for a remedy. Just now attention is being largely turned toward industrial or manual training; and notwithstanding one of the leading papers in the country says editorially, "Industrial education should be kept out of the ordinary common school, these cannot have any further branches," there is wisdom in the movement.

Let us see. One great object in introducing manual training into the schools is to reduce the number of the subjects of daily study, of a purely intellectual character. Some of these are known to be of doubtful utility. Drop them out and give them occupation, just what they need, and this is abundantly supplied by a systematic course in manual training.

Before the child has entered school at all, it has learned to use to the best advantage the eyes in seeing, the ears in hearing, and the hands in manipulating. Vast stores of knowledge have been acquired. But once in the school-room, and these sources of education are cut off. What is to be gained thereafter in knowledge and wisdom must be obtained from a book. Right here manual training steps in; and by means of it, if properly conducted, the little one again sees things, hears things, and handles things. The child is again restored to the outside world, and to happiness.

Labor is apt to be considered disreputable: to work with the hands is looked upon as humiliating. People entertaining these ideas will sometimes resort to follies and crimes, rather than be classed with those who thrive by manual toil. Here, again, a judicious course in manual training steps in and clothes the young person with the honors of usefulness and recognition. Elegant leisure, idleness, and all the resultant follies are not found in his vocabulary.

As a rule, young children do not easily become interested in the study of books. They have small powers to understand, and weak memories to retain what they with difficulty comprehend, and for which they have but little or no use. Hence, if they get on with their studies, it must be done by cramming and learning by rote. Industrial or manual training opens a way to interest them, to develop and employ their perceptive faculties, and to make the otherwise unattractive experiences of school-life cheerful and pleasant.

A great nation engaged in developing its re-

sources, commercial, mining, manufacturing, and agricultural, for the purposes of prosperity and progress, for the comfort and happiness of its people, must have a large increasing force of strong, active, intelligent working men and women. This force of men and women must be educated and trained in the right way from early childhood. Their number has been diminishing of late. Manual training in the schools all over the land will turn the tide, and have a tendency to restore the country more nearly to a normal condition.

Now, is industrial or manual training good for any child or youth? We think so, and for all the children and youth in the land, — for those in the country as well as for those in the city, for the poor as well as the better-conditioned; in short, for all classes and all ages who are engaged in the duties of school. So I think we may be assured that some industry or manual art can be and should be introduced into every country school, whether the cottage by the road-side, or the more pretentious structure for the hamlet, or even the finely constructed institution for the village.

What industry can be profitably introduced? Why, any and every industry within the means of the school, and suited to the capacity, attainments, and age of the pupils in attendance. There are many things that can be done with profit in any and all schools; and, as soon as the pupil enters upon school-life, one of them should be taken up, and each carried forward one after the other, just as the subjects of study are taken up and completed.

SAMUEL G. LOVE.

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## *THE RESPECTIVE FUNCTIONS IN EDUCATION OF PRIMARY, SECONDARY, AND UNIVERSITY SCHOOLS.*[1] — *I.*

IT is generally understood that at conferences such as this the papers read should be of a directly practical kind. I have not always fulfilled this expectation, nor do I mean to do so now. And this partly because it seems to me that a conference of teachers should be held to be also a conference of educationalists, and that questions may therefore be quite fittingly treated in those larger relations which, though not exactly philosophical, are at least suggested by philosophy. Another reason for not being directly practical is that I am tired of the practical, and have nothing more to say. In books, lectures, and printed addresses I have exhausted myself, so to speak, and I am not sure that debate on practical questions is now much needed. We have reached that point at which we wait for action to be taken; and the departmental committee recently appointed, and the universities bill now believed to be in proof, give promise of immediate and salutary activity in many directions.

In primary education the department is now moving on right lines: after many wanderings in the wilderness caused by its own innate perversity, it has now reached the confines, at least, of the promised land. Respectful advice, for the further wise development of the Code, will now be listened to at Dover House, if tendered by competent persons. It has not yet been resolved that 'designated' inspectors who have not been teachers shall go through a course of educational study and scholastic training before entering on duty; but this reform *must* come. As to the training of teachers, the key of the position, as I have again and again pointed out, is the preparatory qualification of the training-college entrant, and this resolves itself into the reform of the pupil-teacher's schedule. This reform the authorities are now considering.

As to secondary education, the first question is the *professional* training of the secondary schoolmaster at our universities; and the second is the better organization of our high schools. I entirely dissent from those who would speak of the secondary system we have as contemptible. On the contrary, I say, without fear of contradiction from any one even slightly acquainted with the history of education, that secondary instruction and secondary schools were never in so vigorous a condition in Scotland as they are at this moment. I also continue to dissent from those who would draw a hard and fast line for the education to be given in primary schools, in the supposed interests of secondary schools. An exception, however, is to be made in those small towns where the secondary school is made easily accessible to the poor man's child, and where the cheap and necessarily inefficient competition of the primary schools tends to starve out the secondary. For secondary education, what we want in Scotland is a permanent commission, elected by the universities and larger school boards, acting as a consultative body under the Scotch department, and empowered to administer a treasury grant of, say, twenty thousand pounds a year in subsidy of local efforts, and on certain conditions as to school staff and organization. With this and a university entrance examination, the secondary schools of Scotland would be in a highly efficient state in less than ten years. The same commission, as regulating the examinations, would institute leaving-examinations qualifying for the university, and content itself, I am convinced, with a trien-

[1] Paper read at the Educational congress, Edinburgh, on the 31st of December, 1886.

nial visitation instead of an annual inspection of the schools; this visitation being for the sole purpose of reporting on the staff and curriculum. Inspection of such schools, in the ordinary sense of that term, is wholly unnecessary, if not indeed hurtful to the cause of education. The governing body of secondary schools should be an elected committee of the existing burgh boards, with the addition of county representatives; the county being taxed for the support of the school up to a maximum of, say, a farthing per pound. As to the secondary or high-school curriculum, it is long since I reluctantly came to the conclusion that this must, for the future, be mainly on the lines of the German real-gymnasium; Greek, however, being taught, but only as a specific subject to the few. In this way, we get rid of the anomaly of 'modern sides.' These 'practical' opinions I here summarize bluntly, having on many previous occasions reasoned them, and I now pass on to the special subject of my address. 'Education' is a big word as well as a great word. It comprehends every influence that goes to the formation of a mind. No man can give an account of it. A genuine autobiography is an attempt to do so. But in this even a Goethe or a Ruskin will fail. These men, like all others, probably owed as much to those subtle influences which pass unnoticed as to the more self-conscious experiences which it is easy to read, record, and estimate. We who have to do with education professionally are apt to forget this, and to exaggerate the influence of the school. We forget that the ancient Persian presented to the world a fine type of manhood, with no schooling at all, in our sense of the word; that the Greek leapt by one bound into the van of humanity, and knew little but his Homer, a few moral apothegms, and his simple lyre; that the Roman had unfolded all his greatest qualities, and had proclaimed himself the coming master of the world in arms and laws, with little or no literary acquirements. It is not by the Latin or arithmetic we teach the boy that we make him a true or capable man: it is by the life we present for his admiration and acceptance, and, above all, by the life which we live before his eyes. Our lives, and the very movements and gestures and exclamations which reveal our lives, are the most potent of all influences in the education of the young.

I may seem to you to have fallen suddenly in love with the trite and the obvious, and to have come to this, that I would substitute for the philosophy of education a few well-worn truisms and platitudes. And, indeed, you are right; for as one grows older, and has wandered far and wide over the meadow-lands and deserts of the educational country, dwelt on the history of the education of the race, and pondered the philosophy of the school, one finds one's self back again at the starting-point, in happy company with the crystallized wisdom of the ages. The last function of science can only be to enable us to see truly what is already there before us to be seen, though covered with a veil: the last function of the philosophy of education is to see the ancient facts of our moral relations to each other, and the truth of the ancient truisms, — to see truly what is covered by the veil of words.

So, then, I am not ashamed to utter truisms, and to say that the formative power of the teacher is not in what he teaches, but in what he is — what he is, first, consciously or unconsciously, in himself, as a living and advancing mind, known of all men, and especially of all boys; and what he is consciously to his pupils in respect of aim, method, and manner.

These certainly are very general reflections, and yet of very close and particular application. For if the end of all our school-striving be not what our pupils ultimately *have*, but what they finally *are* — are as receptive beings in harmonious relation with the simplicity, strength, and truth of nature, and as active helpful beings endowed with sympathy, given to sacrifice, subject to duty, courteous in bearing — I say, if this be so, what a multitude of practical lessons for the teacher are implicit in such a conception!

Let me, in this connection, be strictly practical for a moment, and ask the head master of an English school, "Do you believe this that I have indicated to be the true outcome of school-work? Do you *really* believe? You are a Hellenic and Roman scholar, and you are probably a theologian, and know your Bible. Well, then, if you believe it, is there any reason in the nature of things why, for example, your boys should be kept away from a knowledge of other nations and their commercial and industrial relations with ourselves, and those far-reaching lessons of humanity which such knowledge suggests? Is there any reason why the insular pride, insolence, and self-centring of our British boys — sources these of much evil — should not be modified by a knowledge of other nations of men and their claims to our regard? Can you truly promote what you accept as the true end, the life you admit to be the true life, if you do not by means of the facts of human relations lead the boys of wealthy parents to understand their dependence on the poor, and the true significance of the co-operation of capital and labor? Can any good reason, again, be given why you should not protect the boy's future life by giving him some knowledge of his own frame? Do

you not call it on Sundays, when you preach, the temple of the spirit?" I am speaking, gentlemen, of geography, and economics, and hygiene, as school-subjects, and on which a fifth or sixth form boy would be held to waste his time. And so on I might go for pages, criticising existing practice, in the light of general principles, and suggesting the materials to be used for the making of a true man. So potent are general truths, so keenly practical is philosophy, so penetrating are truisms. It is life that truly educates us: it is the revelation to the young mind of moral and spiritual ideas in their prosaic but fruitful relations to the hard facts and stern duties of common day, that is the main purpose of the great English public school, as of all schools. Can any one who has looked at the records of our law courts for the past seven or eight years believe that this instruction is not needed? Can any one believe that it is continuously given?

But let me pass on to consider the bearing of this by no means, I hope, inapt or inept introduction, to the special question which heads this address.

By the common consent of all nations, as well as of physiologists, the life of the body and the mind of man falls into three periods, — the period up to 7, that of the infant school; the period to 14, that of the primary school; and the period from 14 to 21, that of the secondary school and the university. These, I think, may again be subdivided thus: to the age of 5, the age of 5 to 7, from 7 to 11, from 11 to 14, from 14 to 18, from 18 to 21. But I do not propose to deal here with these various subdivisions, but to confine myself to the larger divisions which we have agreed to call primary, secondary, and university.

Now, let us get hold of some leading idea which shall give us at once guidance and a criterion of judgment at all these stages. That idea I believe to be contained chiefly in the word 'nutrition,' — in the primary stage nutrition of feeling, inner and outer, that is to say, of the emotions within and the realities of sense without, and through these, training, *with a minimum of discipline;* in the secondary stage again, nutrition through the hard facts of life and the presentation of concrete ideals, and through these *a maximum of discipline;* in the university stage still nutrition, but now through ideas, with *self-discipline* as the necessary pathway to the apprehension of ideas.

And here I must try to distinguish between training and discipline, terms often confounded. If I carry a child through the explanation of any object of knowledge, step by step, in the true logical order of that explanation, and, repeating this again and again, finally cause him to reproduce the process, I am calling into activity his intellectual powers in the order in which they alone can truly comprehend. I am thus training him. If, on the other hand, I call upon him to apply past knowledge to the explanation of some *new* thing, I discipline him. For example: the geologist may explain to me a section of the earth's surface by exhibiting in logical sequence the causes whose operations have made it what it is. As often as I follow him through this explanation my faculties are at work in their natural order, and I am thereby trained. But if the same geologist, knowing that he has conveyed to me through his past instructions, principles and causal forces, takes me to a new section of country and calls on *me* to map it and explain it, he disciplines me. Again: in the moral sphere which concerns doing under the pressure of motives, when I lead a child by the hand and guide him to the feeling of the right motive, and to action in accordance with it, I train him. When I throw him on his own resources, and, withdrawing my fostering hand, call on him to do his duty, which means to sacrifice inclination to the moral 'ought,' — to offer up self to virtue, — I discipline him. Training is the peculiar virtue of the primary school. In intellectual and moral training there is the following of a stronger on whom the weaker leans: in discipline there is the self-exertion of will in the face of difficulties, this will being the root of our distinctive humanity. Training may make a well-disposed youth, but it is discipline alone that makes him strong, virile, — a will, a man. Discipline is the peculiar virtue of the secondary school.

When the primary and secondary schools have attained their end, we have a great result truly; but, after all, our pupil is as yet only a man among men, a capable, upright citizen, it may be. That is all, though much. He is fit for more than this, however. He can rise above mere world-citizenship, and become a citizen of a city not made with hands. The divine in him — his spirit-hood as distinguished from his mere man-hood — claims fellowship and kindred with God. He can rise to the contemplation of ideas, and regard them face to face. The true is an idea: it is the motive inspiration of scientific inquiry. The beautiful is an idea: it is the subtle perception of the music of creation. The good is an idea: it is the comprehension of the harmony of the universal movement. When man attains his full stature and to communion with ideas, he raises his head above the vaporous clouds of earth and breathes an 'ampler ether, a diviner air.' He now begins to see the cosmic order as truly a spiritual order, and, returning to the ordinary life

of the citizen, he descends from his Sinai, not to despise the mean things of the daily life, but now rather to see the God of the mountain-top in them, and to illumine all with the light that comes from within. He no longer sees with the eye of sense. For him nature is now bathed in the light that never was on sea or shore. The glory of setting suns, with all its splendor, is now to him only a dwelling-place for the universal spirit; the infinite variety of nature, only the garment we see Him by. The palpitating thought which *is* all, and in all, now finds in the spirit of man a responsive pulse. Blessed is the coming of that day. It is to sow the germs of this life of the spirit, to foster this into adolescence, if not maturity, that the university exists; to give food, nutrition of this kind, — to supply the spiritual manna which will never fail us in the wilderness-wandering of earthly existence, as each morning we rise to a new day. The discipline of this period is *self*-discipline. Such I conceive to be the three stages of education. These be brave words, some of you, perhaps, will say, but what guidance do they afford? By what cunning application can they be made to bear on the business of the teacher's life? The application will be apparent enough to others. Depend on it, principles are the most practical, the most potent, of all things. They are inexhaustible fountains of every-day detail.

S. S. LAURIE.

## THE PRUSSIAN MINISTER OF INSTRUCTION ON FEMALE EDUCATION.

MINISTER VON GOSSLER presided over the tenth annual congress of teachers in high schools for girls at Berlin, at which about five hundred teachers were present. In his opening address, Herr von Gossler discussed female education in general, and stated that the chief difficulties connected with the instruction in girls' schools are two: "first, there are still a great many men and women who hold that a girl's character, and the emotional part of her nature, are the only things that require developing, but that the intellectual side may be left to chance; second, society is at present in such a state, that the question, 'What will become of our daughters?' is uppermost in the minds of the parents and of all true friends of the people. The serious nature of these problems has often led to attempts at introducing things into girls' schools which do not belong to them, and at putting girls in every respect upon an equality with boys. As Teutons and as Christians, we must ever hold that woman has equal rights with man, but on physiological grounds she is not the same in nature as man. Hence the aim of education should be to recognize this diversity of characteristics, and to build accordingly. It must also be remembered that the school has no claim on girls for as long a period as on boys, — a difference which is based in part on the natural difference of sex, and in part on time-honored custom. The principles on which woman in Germany has been developed, and which are rooted in our nature, must be preserved and handed to our descendants as intact as we found them. Woman here, the centre of all Christian, humane, and ideal thoughts, is rightly considered with us as the centre of the home and the family. The best men and women of all times have always held that the well-being of a nation is based on family-life, on the home, and on woman. I say woman, for I do not mean specially the wife. Therefore our endeavors must be to hand down the nature of woman, with all the perfections inherent in it, unaltered to future generations. Woman belongs to the home, and must live for it: her share in art and science must always be looked upon as a secondary consideration. At a later period of the session, Herr Wübchen-Oldenburg, director of a high school for girls, offered a resolution stating that the object of education for girls should be to train woman to be the helpmeet of man, intellectually as well as otherwise. He claimed that "this aim is not attained — often it is made impossible — through the increase in the number of subjects taught, which leads to superficial knowledge. Hence the subject-matter of the studies is to be restricted rather than extended. It might well lose in breadth in order to gain in depth. The school-course ought to remain as it was fixed at the meeting of 1873, from the end of the sixth to the end of the sixteenth year. The new plan of studies ought to be tried provisionally in Berlin, before applying it to the country at large. The results of the discussions seem to be that the number of school-hours, at least for the four lowest classes, should be diminished, the subjects now taught should be rearranged, and more time should be allowed for bodily exercise.

## POLITICAL EDUCATION.

MR. FREDERIC HARRISON, the well-known English essayist and follower of August Comte, is president of the Social and political education league of England. He took for the subject of his recent presidential address 'Political education,' and spoke at some length. He referred to the great political excitement of the time, and pointed out that public opinion needs to be continually reminded, that, if politics is to be fruitful, it must be based on history, law, and philosophy. He

next spoke of the good work being done by the league through their courses of lectures, and incidentally referred to gratuitous teaching in a way that reminds one of the Athenian opponents of the sophists. This principle, Mr. Harrison insisted, is essential to any high standard of educational good.

It is practically impossible to give any adequate remuneration for really good teaching. True knowledge is priceless: the teacher must have been taught by a thousand influences and long generations of teachers; and who would say whence came that idea, or what that particular thought was worth, or how much per hour ought to be paid for good advice? The forming of a mind, the fortifying of a human soul, has no market-price, and is best when freely bestowed. Those who have been taught, ought, by the laws of the chivalry of culture, to teach. It is said that people are apt not to value that for which they do not pay; that the work which is not paid for is not well done. There are no doubt cases where this statement holds good; but no money will buy a competent prime minister or an Archbishop of Canterbury, or can really compensate a good teacher. Mr. Harrison had no objection to paid lecturers in their proper place; but all knew how strong was the inducement for a paid lecturer to amuse rather than to instruct. The teacher ought to be in the position of the higher and wiser helping the weaker and less instructed; and no sophistry or convention could obscure that truth. It is the very first duty of the teacher to make the learner feel his shortcomings, and press him to use his mind more strenuously than before. He hoped that the league would hold on to the gratuitous principle as its very life-blood. The central idea of the league was that politics could be made a subject of systematic education. This idea was the most important discovery of the age; it was the most potent advance made in the history of human thought. Down to the close of the last century it had been thought that the immutable laws of science were possible only in the physical world; and it was only in our present century that a general but vague impression had filled the public mind that there was some such thing as a social science, no less than a physical science. By common consent the science had two great sides, — in Mr. Herbert Spencer's language, the statical and the dynamical. The study of institutions and the study of history, the knowledge of the permanent elements in any society and of the course which that society had taken in its evolution, — these were the two great instruments, going side by side, of their educational work, — the analysis of institutions on the one hand, and the philosophy of history on the other. The history of England had been studied scientifically only within the present generation, and the effect on the politics of our time was now very visible and profoundly active. Looking at the legislation of the last fifty years, we should find that it had been in a marked and increasing degree based upon something which might be called euphemistically history, social science, and political philosophy. Turn whichever way we would, in legislation we found that statesmen made an effort to get guidance and inspiration from those principles. The idea that they ought to do so, distinguished the nineteenth century from the eighteenth, and the sixteen preceding centuries; and our children in the twentieth century might see the idea fully developed. It was still in an infant, even an embryo, state, and was not a science constituted and systematized. It would be, however, a complete misconception to assume that we could not bring science to bear upon society until it was fully constituted. To bring habits of scientific training to bear on things social is a modest aim enough, but is one which might be of exceeding usefulness in the din of party and the daily battle of bills, clauses, and personal combats. Such lectures as the syllabus of the league comprised, carefully handled by men able to discriminate between knowledge and prejudice, must clear the air and sober the excitement of political debate. We have now arrived at such a stage that we have committed the destinies of races in the aggregate more numerous than those which obeyed Xerxes, or Alexander, or Caesar, to the millions of electors of these islands, and the place of England in mankind rested on the event of that great problem. The board schools, halfpenny newspapers, and cheap literature are not enough for the education of our masters. Mr. Harrison said that he knew something of working-men, and he felt pretty sure that they would never take their opinions from any one, but form them for themselves; and the league, at any rate, did not seek to give them opinions. It was to help in forming and training their minds that the league offered to put them in the path of thinking broadly, cautiously, and with system, and to feel how subtle and orderly a thing was the organization of any human society; and all this might be done without being supposed to have mastered social science, or without wishing to impose upon men indisputable dogmas of any kind. The best education of the present day was very far from reaching a high standard in method, completeness, or coherence; but, such as it was, it must be accepted and used. It would be the unwisest course of all to be forever disputing what a good education ought to be, instead of using the imperfect

instrument at command, and trusting to the younger generation to work out for themselves a more truly rational system. He would encourage the friends of the league to continue to extend their work, if not for others, for their own sake. His experience was, that to give a course of lectures was to go through a course of self-education. To lecture was to undertake a very solemn and trying task. It was to lay one's self bare to view, and to ask one's fellow-citizens to judge whether one's education had been of any good worth speaking of. He trusted that with them it would be found that the attempt to teach others proved their own best education.

## *MANUAL TRAINING AND PUBLIC EDUCATION.*[1]

"THE public school," said John Quincy Adams, "is one of the four pillars of the state." It is firmly intrenched in the heart of every loyal citizen. It is always on the side of good order and of good morals. The man who has ventured to suggest any important change in the public-school system has been suspected of weakness in his head, or dishonesty in his heart. But here is a radical change from the public school of Horace Mann, of Daniel Webster, and of the host of other worthies who have either aided in its establishment, or have been grateful partakers of its benefits. It is only reasonable to ask, Why this change in the system to which a large part of the prosperity of the country is undoubtedly owing? Why add to the geometry and philosophy which have descended to those quiet halls from the academic groves of Athens? Why add to the poems of Virgil and the orations of Demosthenes, the tool of the mechanic and the whir of modern machinery?

As an instrument of culture, — for it was Emerson who said "a man should have a farm, or a *mechanical craft* for his *culture*," — the manual-training department of the public school was unnecessary a hundred years ago. As a means of teaching the mechanical arts, it would even then have been an improvement on the apprentice system, although the apprentice then occupied a very different position in the shop of the master. But the New England boy of the olden time, like many a country boy of the present day, had a manual training outside of his school. The Yankee knack at turning one's hand to almost any thing has become proverbial. The mechanical ingenuity of the New-Englander is to be attributed only in part to his literary training. In the early New England life, and in the New England villages in which the pristine habits are preserved, John Fiske remarks, "The universality of literary culture is as remarkable as the freedom with which all persons engage in manual labor." — "The stony and somewhat sterile lands of New England," says the Englishman Mather in his late report to the British parliament, "require intense activity, industry and skill on the part of the farmer, to make a living. As hired labor is very dear, he depends on his own household for help. Every kind of work has to be done at home. Blacksmith's, wheelwright's, machinist's, carpenter's, and hydraulic work becomes as familiar to the farmer, in a rough and ready way, as ploughing, tilling, sowing, and reaping. All handicrafts, in a greater or less degree, are acquired. The farmer's boy is thus provided with an industrial training of the best kind in and around his home. His wits are sharpened, his perceptions developed. There is a large field for the immediate application of knowledge acquired at school, on the one hand; on the other, the school exercises and lessons are more readily understood by a boy or girl having in daily life to deal directly with natural forces and laws. These district schools, holding only twenty weeks in the year, associated as they are with agricultural and mechanical occupations, produce better results, as a whole, among the artisan classes, than the city schools, the attendance at which is for the entire school-year of forty weeks. My attention has been drawn to this fact by many employers and educationists, and it has been confirmed by my own observations. *It suggests the importance of introducing into the elementary public schools of cities some industrial training.* 'Our brightest boys come from the country,' is a phrase which has become very familiar to me in America."

Such are the observations and conclusions of Mr. Mather. That they are true cannot be denied; and since they are true, the reason and the wisdom of this new departure become apparent.

The influence of physical vigor and manual skill in developing sterling character is nothing new. In the virile days of Rome, when "to be a Roman was greater than to be a king," there was a remarkable resemblance to the early New England life.

"The oldest lays of Rome," says Mommsen, "celebrated not only the mighty war-god Mamers, but also the skilled armorer Mamurius." "The Roman boy, like every farmer's son, learned to manage horses and wagon, and to handle the hunting spear." "In the earliest Rome the arts of forging and wielding the ploughshare and the sword went hand in hand, and there was nothing of that arrogant contempt for handicraft which was afterward met with there."

[1] From the *Industrial world and iron-worker.*

Nor does our own republic fail to furnish us illustrious examples of noble men worthy to be ranked with Cato and Brutus, whom an admiring nation lifted from village or farm to the highest places of honor and power. I need not call the roll from Washington to Lincoln; I need not name Garfield and Grant, and a host of others.

Notwithstanding a popular superstition, there is no necessary antagonism between brain power and muscular power. A man may be a scholar and artisan, as well as a scholar and an artist. Physiology teaches that the brain is best developed by the best development of the body. Dr. Henry Maudslay says, "It is a foolish and fruitless labor to attempt to put asunder mind and body, which nature has joined together in essential unity. The right culture of the body is not less a duty than — is indeed, essential too — the right culture of the mind. The muscles are not alone the machinery by which the mind acts upon the world: their actions are essential elements in our mental operations."

Dr. Edward H. Clarke says, "The development of the soul and mind — of the *ego* — resolves itself into the development of the brain. No perfect brain ever crowns an imperfectly developed body." Dr. Clarke, writing *not* in the interest of manual training, maintains that parts of the brain preside over special muscular movements, and are more or less developed by such movements. And it is a well-known fact that that side of the brain which controls and animates the right hand is, in right-handed persons, larger than the other side; and an eminent living physiologist has lately recommended the training of the left hand of children, in order to increase the brain-power of the race. Of course, it is possible to develop one part of the human organism at the expense of another. We have illustrations of this in the gourmand, frequently in the scholar, too often in the laboring man, driven by stern necessity.

Tyndall remarks, "We need muscle as well as brains, character and resolution as well as expertness of intellect. Lacking the former, though possessing the latter, we have the bright foam of the wave without its rock-shaking momentum."

Before considering some charges brought against public schools, I wish to speak of the opinion which has gained currency in certain quarters, that the advocates of manual training are the enemies of the public-school system. Whatever may be the sentiments of others, this accusation is groundless in regard to myself. To the superiority of the public schools of America I am always ready to bear cheerful testimony. But, in my judgment, the position taken by the friends of manual training in regard to public schools is of far less importance than the position of the friends of the public schools in regard to manual training. In many cities it is clearly perceived that manual training is neither the enemy nor the rival of the public school, but is an essential part of it.

Both European and American schools must plead guilty to the charge of over-pressure. Medical men testify to the injurious effects of long-continued taxing of the brain combined with inactivity of the body. The public has insisted upon long hours and close confinement of children in school, often against the protests of their teachers. The latter, in their laudable ambition for the progress of their pupils, have fallen into the same error. After making allowance for the ill health due to late hours, improper food, and other causes for which parents are responsible (and this amount is greater than parents will admit), the ill effects of school-life on many children must be acknowledged. It is not surprising that the proposition to make an addition to our already overloaded curriculum seemed to many a move in the wrong direction. The assertion that a pupil could accomplish his regular school tasks, *plus* the manual work, with less tax upon his strength than that demanded by his academic work alone, certainly has the appearance of a paradox. But such is the truth. Improved health, more rapid advancement, greater enjoyment of school, is the frequent voluntary testimony of pupils in manual-training schools, and of their parents. On the other hand, no pupil entering the Chicago manual-training school in good health has, as far as my knowledge extends, ever been withdrawn on account of loss of health from school-work. The manual-training school recognizes the fact that alternation of work is rest. It brings into activity a rested portion of the brain, and permits the restoration of the wearied parts. A course in Latin and Greek, combined with violin and billiards, was lately prescribed for a railway president threatened with softening of the brain from overwork. A cure was effected. Assuming, however, what seems *not* to be true, that the book-work of the high-school boy exceeds in amount that of the manual-training school pupil, it is still true that the best knowledge of the world and of the age in which he lives, and the greatest power to subjugate that world to his own will, is in the possession of the graduate of the manual-training school.

There is a mental discipline obtained from the course in wood and iron working. The knowledge of the properties and laws of matter secured in the laboratories of the manual-training school exceeds the knowledge that can be obtained in the ordinary school. Three years' actual work

with wood, iron, steel, brass, zinc, lead, with plane, saw, lathe, hammer, forge, cannot fail to arouse and stimulate a boy's mental faculties. The high-school boy's knowledge of the laws, powers, and capabilities of modern machinery is nothing. To him this is a *terra incognita*. Mental power is needed to understand a steam-engine, as it is needed to analyze a sentence. If the boy has read three books of Caesar instead of four, but in place of the fourth book, 'De bello Gallico,' is able to describe the working of every part of a Corliss engine, he has not lost mental power by substituting the study of the modern giant for the study of Caesar's bridge. Three years in a training-school undoubtedly fit a boy to grapple with the problems of life better than three years in the high school. In Baltimore, Philadelphia, and Toledo it will be shown that three years in a high school with manual training give a boy a better start in life than three years in a high school without manual training.

It is the belief of many that elementary education should include nothing except a purely intellectual training (with, perhaps, some attention to morals and practical hygiene); and that the school, certainly the public school below the university, has no concern with the trade, business, or profession which the child may follow in after life; and that the public school would be guilty of leaving its true sphere should it give the child any bias whatsoever to any calling. The position is also taken, that, whatever may be his future vocation, this training of the intellect is the best possible preparation which the child can have.

No word of ours shall ever be quoted derogatory to the highest intellectual culture for all men and for all women. This age has justly been called the age of iron, of steel, of steam, of electricity. But it is the age of steel, steam, and electricity because it is pre-eminently the age of *brains*. Any education that neglects intellectual culture, or makes it secondary to any physical training, is an education to be condemned and avoided. A republic should have no proletariat. The education advocated by this paper recognizes the culture of the mental and moral faculties as essential to, nay, as the foundation of, the highest development of the individual, whether artisan or artist, ploughboy or president. It would not abandon, but would, if possible, elevate the high American ideal which would lead every child into the pleasant and fruitful fields of literature and science. But it recognizes the fact that in his present state of existence the boy has a body as well as a mind; and it protests against the mediaeval doctrine that the highest culture of the intellect is obtained by the mortification or neglect of the physical nature. On the contrary, it asserts that the connection of mind and body, however that mysterious union is effected, is such that the proper training of each is essential to the highest development of the other.

The first great object of education is preparation for the battle of life. To the great mass of mankind this must always be the primary, if not the sole, object of education. The great majority of children leave school at a very early age, averaging probably thirteen years. Many of these children leave school to assist at once in the support of the family; many others to obtain some education, not found in the public school, which shall fit them to earn an honest living.

Every year there is need of a large addition to the number of skilled mechanics. Where is the boy to learn the elements of artisanship, unless in school? Some one has said with, it is to be hoped, large exaggeration, that in America a trade can be learned nowhere except in jail. Why not teach in school the elements of carpentry as well as the elements of book-keeping? Why bias the boy in the direction of an accountant's life, and not in the direction of house-building or cabinet-making? Is the one art more essential than the other?

A boy can be taught in school the use of a plane as well as the use of a pen, the use of the lathe as well as the use of the lexicon. He can be taught the use of tools *scientifically* better than the 'rule of thumb.' He can be taught by a skilled mechanic who is also a skilled teacher, in less time than by a skilled mechanic who is not a teacher. Teaching is an art, and the highest success in it demands more than the simple knowledge of the matter to be taught.

There are in the public schools of the United States more than ten millions of children. We develop their *brain* power, we let their *hand*-power lie inactive. It is no exaggeration to say that of these ten millions, soon to become men and women, two and a half millions must support themselves by the labor of their hands. What are the public schools doing to train these hands?

Say what we will, the old Greek was right: "Teach the boy what the man will need." For a nation of horsemen and warriors the ancient Persian education was admirable: to ride, to shoot, and to speak the truth.

It is a remarkable fact — no, it is *not* a remarkable but a very suggestive fact — that the American Indian is taught, in the schools of the American missionary society, exactly what he needs to make him a self-supporting, self-reliant, upright man. The foundation of his scholastic training includes four R's, the fourth being *religion*. These

occupy half his time: in the other half he learns to till the soil, to build his house, to repair his plough and his wagon. But it is remarkable that the white man should give to the Indian child a more comprehensive education than he gives his own. The gravest problem that confronts the American people is the education of the masses. Our wealth has increased, but so has our poverty; our learning, but our ignorance also; refinement and joy, but also degradation and misery. The march of civilization has also been the march of vice and crime. "Knowledge fights on both sides in the battle between right and wrong." "The association of poverty with progress," says Henry George, "is the great enigma of our times. It is the riddle which the Sphinx of Fate puts to our civilization, and which not to answer is to be destroyed." Can the riddle of the modern sphinx be solved? Can the diseases of society be remedied? While I am firmly convinced of many advantages arising from hand and brain training, I do not regard it as a panacea. No single agency can bring immediate and permanent relief to the body politic. The mob that cries for 'blood or bread' has passed beyond the influence of the school, and demands a sterner discipline. The hope of the state lies in its youth. Too long have our schools inculcated a taste and an admiration for purely intellectual accomplishments; at least, have cast a slur on the development of manual skill. By far too many has education been regarded simply as affording an avenue of escape from all labor, as the ability to 'live by one's wits.' We rejoice, then, in the extension in several cities of the public-school course. We believe it to be a broader and a wiser education; that it is based on a true philosophy; that it calls into activity powers that have lain dormant, powers of the mind as well as of the body; that it develops a manlier, more self-reliant spirit; that it elevates industry, and teaches respect for true manhood and womanhood under whatever guise. We believe that it will materially assist in solving the problem of modern civilization, since, to use the words of William Humboldt, "whatever we wish to see in the life of a nation, we must first put into its schools."

H. H. Belfield.

## THE REAL-GYMNASIUM.[1]

While in Prussia and North Germany the contest over the relative advantages of the training given in the real-gymnasium and that concerning its rights and privileges has been gradually assuming a very violent character, there has been developed in Wurtemberg a real-gymnasium — the one at Stuttgart — so quietly and peacefully, and so well encouraged by those who in Prussia are the real-gymnasium's bitterest opponents, that the Swabians may rightly be envied for the progress they have made in this direction. This development is described in the work mentioned above, and with the avowed intention, successfully carried into effect, of conciliating the opponents of this new form of school. The author considers himself called upon for these words of conciliation and explanation, from the fact that for twenty years he has been the rector of this institution. Inasmuch as the real-gymnasium in Stuttgart has met with but slight opposition, the author, in his position as rector, has been able to observe quietly the effects which this system of education must have upon his pupils. It is seldom that we see the two educational forces, language and mathematics, with their influences on children, youths, and men, so impartially weighed as in this case.

The history of the Stuttgart real-gymnasium is very interesting for a Prussian, because there the teachers in the gymnasia are its friends, while those in the real-schulen where Latin is not taught are its opponents. It is not possible to enter into this subject more fully, and I will content myself with a few remarks that may induce the reader to refer to the book itself.

In regard to rights and title, the author demands with emphasis that those of the real-gymnasium should be equivalent to those of the gymnasium. The delay in this matter appears to him an injustice, but he does not wish to interfere with the authority vested in the gymnasium. Up to this date the ministers of the interior and of finance in Wurtemberg demand from the graduates of the real-gymnasium a supplementary examination, in which the necessary answers are translated into French instead of into Greek, for entrance to the higher courses of study in their departments, and those who succeed are entitled to follow the studies offered by the faculties of philosophy, natural science, and political economy. To qualify for studying in the other faculties, there is only an examination in Greek, and a translation of German into Latin, required, and not a Latin essay. This is an important concession in comparison with the Prussian demands. The real-gymnasium in Stuttgart is founded for, and expressly appointed to prepare, students who do not study Greek in the gymnasia for entering the courses offered by the above-mentioned faculties, as well as in the technical high schools. It should be a model for all Germany. For once, students have in a very satisfactory manner received

[1] A review of C. Dillman's 'Das Real-gymnasium,' translated for this journal from *Pädagogisches Archiv*.

the highest marks in examinations, and have shown themselves equal, if not superior, to the students of the gymnasia. This fact has been substantiated by the minister of state, Dr. von Sich, in the public records, as well as in private letters. Six former pupils have gained professional chairs in the high schools, and among them three are in Prussia. These, as well as the pupils from Principal Krück in Wurtzburg, for Bavaria, and from Principal Steinbart in Duisburg for North Germany, have given convincing proofs that the educational system of the real-gymnasium is equivalent to that of the gymnasium. Since the study of Latin in the real-gymnasia was increased in 1882, the faculties of law will scarcely be able to oppose any longer the admission of their graduates. The one in Stuttgart has furnished proof that they are able to understand the institutes and pandects, as they have passed very good examinations in these branches

Twenty years ago the author laid down this proposition: that, in order to preserve the proper cohesion in our education, the realist should be educated in a more humanitarian manner, and that through the one-sided humanitarian education given in the gymnasia the connection between life and the school was severed, while it gave just cause for the objections raised against the gymnasial system. The Prussian government has tried to remedy this defect, and mediate between the two systems of education. It has made the earlier real-schulen more like the gymnasia by increasing the amount of Latin, and has made a real-gymnasium out of the former real-schule. That this must bring an increase of privilege is clear.

Du Bois-Reymond, formerly a violent opponent of the system, now desires to open the profession of medicine to the students of the real-gymnasium, and the faculty of that science in Tubingen no longer opposes this concession. According to our author, the free entrance to all the faculties will eradicate this *Kulturkampf* which now threatens to waste the best power of the German people. The author considers the question concerning the privileges of the gymnasium in a very direct way. The teaching of Greek in a high school is a distinguishing mark as to whether it is a gymnasium or not. In the beginning of this century, Greek was an essential part of the study in *no* gymnasium. Herder, Lessing, Schiller, and Goethe first drew the nation upon classic ground, and the German student was obliged to follow if he wished to be in accord with the spirit of the age. Latin formed the basis; and because it was so strong, the superstructure Greek attained such fine proportions. From this the author draws the conclusion, that because the gymnasium's teaching was sustained by the approval of the greatest among the people, and supported by the whole spirit of the times, it has received its sudden impulse during the last fifty years; and that the system of education can only reach its highest point of development, and at the same time attain the ability to influence the age we live in, as well as instruct the young, when it is in accord with the ideas that are agitating the world, gaining its incentive from them, and in its turn placing them before the young. Latin is *the* language of the gymnasium. As long as the real-gymnasium makes a point of Latin instruction, and with all earnestness and power interests itself in the teaching of that language, it has a right — an historical right — to be a gymnasium, to be called by that name, and to be recognized as such.

Max Müller, professor in Oxford, and the greatest living philologist, replied to a committee of Hungarians who asked him whether they should introduce the system of gymnasia as it existed in Germany, that Latin was indispensable, as our whole culture rested upon that language, and that Greek should, if necessary, give way to it.

Upon many sides the old question concerning Greek is renewed, whether one must study Greek literature and customs, through the reading, necessarily in a bungling way, of the original. The author thinks, that for the teacher, with his attainments and enthusiasm for Grecian antiquity, this is essential, but not for the pupil.

Von Rümelin, always a conservative friend of the gymnasium, says that the important works of the Grecian authors are too difficult for any except the most gifted as well as the most studious pupils of the gymnasium.

The philosophers themselves use a translation of Plato's 'Republic' by Schleiermacher, and why should not a student of the higher classes read a translation of one of the tragedies with more aesthetic appreciation than he could feel in stumbling through a few strophes from one of the choruses?

Never was there a greater number of classically educated men than in the assembly held at Frankfurt-a.-M. in 1848. Never did assembly have a meeting less productive of results, nor one with a more lamentable ending. Yet it held the noblest enthusiasm, and its members had the best intentions. The ability to create something great and lasting was totally lacking; and an eminent writer in the *Allgemeine Zeitung* pronounced the hard judgment that the old gymnasial system weakened the spirit of energy and enterprise.

The majority of men whose names and deeds have become historical have not been trained in the gymnasium. Among them are Thorwaldsen,

Schliemann, Hermann, and the officers of our army, while the most ardent friends of the gymnasium have never been able to consider Bismarck's inclinations favorable to this system of education.

David Friedrich Strauss, a philologist of a very high order, the embodiment of the critico-philosophical method, a master of both poetry and prose, who, like Luther, took a firm hold upon our nation, was a general without an army. The mighty thinker lives forgotten and unknown. In the evening of his life the meteoric splendor of his name brightens the world once again. In his 'Old faith and new' he falls without judgment or method upon the newly risen star of Darwinism to extinguish it. His classical education remained narrow and partial, so that he lacked the organ for comprehending and justly judging a theory of natural science.

This will be sufficient to create a desire to read the pamphlet. The requirements in supplementary examination in Greek and Latin demanded from the graduate of the real-gymnasium in Prussia since 1882 are severe, and perhaps too difficult for a man of ordinary talents; still it is to be hoped that they will be partially or entirely set aside when among us also the hard and bitter fight concerning authority gives place to a more judicial state of mind, and the government of the schools shall show greater signs of shifting their ground.

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## *MODERN METHODS FOR BEGINNERS IN LATIN.*

THE boy of the present day has no idea of the advantage he enjoys over the boy of the last generation in respect to ways and means of attaining a knowledge of the ancient languages. No drearier memory haunts the mind of the writer than that of the twenty months or more in his youth devoted to the acquisition of Latin accidence. The theory of his instructors was that the promised land of actual Latin literature was only to be entered after the full tale of disciplinary wanderings through the woful deserts of declensions and conjugations and rules and exceptions, and, above all, the dismal wastes of the manufactured Latin in which Dr. Arnold has embalmed the virtues and vices and miscellaneous sentiments of Balbus. It is painful to think how amazed the well-meaning instructors of that day would have been at the very name of the little book which is now so deservedly popular, 'Six weeks' preparation for reading Caesar.' Yet this name very accurately illustrates the prevailing tendency in preparatory work. It is becoming an established principle with thoughtful teachers that no more in Latin than in English is parrot-like ability to repeat a vast number of grammatical forms and rules an indispensable prerequisite to the reading of an interesting narrative written in a simple style. The mediaeval idea that grammar as an abstract science is well adapted to the development of immature minds has at last succumbed to the stubborn resistance with which such minds have instinctively met all attempts at such development. How many teachers who have ever undertaken to pursue the old plan in respect to grammar, whether of the vernacular or of foreign languages, can recall a single pupil who did not pronounce the subject 'awfully dry'? Such a case is as rare as the juvenile prodigy that professes really to like the old-fashioned arithmetical cube root. But in the skilful evolution of a grammatical principle out of some striking passage of Irving or Caesar, what boy will not find interest?

For the tyro, as for the scholar, the true and natural method of mastering the logic of a language is to seek it in the literature of the language. The consciousness of this truth is the basis of the modern tendency to get the beginner in Latin into immediate contact with Caesar as soon as possible. There is some lagging yet among the older generation of instructors as well as among the less energetic. It requires more labor on the teacher's part to so employ the new method than to cling to the old. Equipping a boy with grammar and reader, and seeing that he memorizes a certain amount each day, constitutes the bulk of the teacher's work under the antiquated system. But to secure to the pupil in three months such familiarity with the forms and meanings of words and the leading principles of syntax as shall prove an efficient armory in the attack on connected prose, demands a degree of discriminating and intelligent care that is to be found only in the really capable instructor. For the presentation of the forms and syntactical principles necessary under the new plan, a large number of excellent text-books have already been offered to the public. It has been left to the thoroughly competent instructor of the Adelphi academy of Brooklyn to furnish a handbook of great value in the acquisition of a vocabulary of Caesarian and Ciceronian words. The basis of the plan presented in 'Latin word-building' is the belief that the aptitude of the juvenile mind for the detections of resemblances in the orthography and sound of words is the most useful quality to employ in the formation of a vocabulary. Accordingly, Mr. Gates has collected in alphabetical order the root-words

*Latin word-building.* By CHARLES O. GATES, A.M. New York, Appleton. 24°.

that occur in the first four books of Caesar, and has appended to each its principal derivatives as employed by Caesar and Cicero. In a second part are arranged sentences containing the words given in the vocabulary, and illustrating their use. The sentences are *bona fide* excerpts from the authors mentioned. By way of appendix, a chapter is added on the main principles in the formation of derivatives, and exercises on the declensions and conjugations.

The author's theory is, that the memorizing of the primitives, and the perception of the general principles in the composition of words that will soon arise from practice, will prove the shortest and at the same time the most effective means to the attainment of a vocabulary. There can be no doubt that the theory is a sound one. The little book before us contains an outline of the practical application of the theory. That the plan may be carried out indefinitely is obvious, and the author has accordingly left space after each root-word for the insertion of new derivatives as they occur in the pupil's later reading. The lists given in the book are in general exactly suited to the elementary character of the work. No pretence is made to fine-spun etymological accuracy. Words cognate to the root-words, as well as those derived from them, are grouped together. It is likely that in some cases the connection of words given as derivatives with the root-words will be found too remote for the beginner. *Cautes*, for example, from *acuo*, involves a rather profound etymological principle. *Bellum* from *duo*, *vates* from *for*, and *primus* from *prae*, would not be easily grasped by a twelve-year-old boy. So, too, it would probably be as useful for a beginner to put *copia* and *imperium* among the primitives as to class them as derivatives of *ops* and *paro*. Some etymologies appear which are not only quite doubtful, but are apt to be very misleading. Such are *merces* from *cedo* (instead of *mereo*) and *clemens* from *mens*. *Pollex* from *valeo*, and *cervix* from *veho*, are probably doubtful, and certainly not useful in this book. But, in spite of such little inaccuracies in detail, there can be no question as to the value of the book in general. Many a struggling teacher will arise and call blessed the man who conceived and brought forth the little manual.

W. A. D.

## *SOME RECENT CLASSICAL PUBLICATIONS.*

*Aeschylus: the seven against Thebes.* By A. W. VERRALL, M.A. New York, Macmillan. 8°.

THE literary interest that one feels in the 'Seven against Thebes' is of a purely negative kind. The play has always served as a striking illustration of the divergence between ancient and modern criticism, both in theory and in practice; for while antiquity gave high rank to what is very little more than a dramatic monologue, or rather series of monologues, modern literary judgment has been much less favorable. Mr. Verrall, in the very admirable introduction now before us, has attempted to show that the modern view is based upon a number of "misconceptions, small in themselves, but not small in their effects;" yet he is nevertheless constrained to admit that there does exist a certain incongruity in the combination of extremely rapid, even hasty dramatic action, and the measured pomp and stateliness of the Aeschylean dialogue. In fact, as he well points out, the structural slowness of iambic verse is always open to the charge of inappropriateness, and when used by Aeschylus, who knew not the metrical arts of his successors, the discrepancy between the exigencies of the action and the measured rhythm of the verse becomes a serious bar to the success of a play like this.

Mr. Verrall has in general performed his task well. Scholars who have only known him by his 'Medea' will be agreeably disappointed in the present volume; for in it he exhibits a much riper scholarship, a much more original style of treatment, and a wider range of vision. In fact, he seems to have profited greatly by a very thoughtful criticism of his former work, which appeared some years ago in the *Philologischer Anzeiger*, by Dr. L. Schmidt, — a criticism to which, in fact, he has made a direct reference in the smaller edition of the 'Medea.' In the present commentary he is even more to be commended for what he has rejected than for what he has advanced new. While following the text of Wecklein, he has had the courage to restore some of the older readings, and, furthermore, has been able to defend them with much sagacity and taste. Thus in v. 998, where modern editors have almost universally read *εὐνοία* from the late manuscripts, Mr. Verrall properly restores *εὐναία*, making it a substantive with *χθονὸς* depending upon it, — a reading that is not new, for it was defended by the scholiast, yet which has seldom been properly understood. Mr. Verrall rightly justifies it by referring to the *ποῦ χθονός . . . πάρευνον* of vv. 993–995, and also to the ironical sentence in v. 1012, which loses much of its point if we read *εὐνοία*. In many other passages Mr. Verrall shows a similar good judgment and sober discrimination. We might, perhaps, reasonably join issue with his assertion, on p. 33, that *μαίνων εὐσέβειαν* *necessarily* requires a personification of *εὐσέβεια* to make tolerable Greek: for such passages as Pindar, N. III. 25, Soph. Antiq. 1044, and Eurip. Hipp. 1437, make the

ordinary usage so common as to require us to regard the non-personification in the present passage simply an Aeschylean turn of expression, by no means far removed from the language of ordinary verse.

Typographically the book is superb. A more beautiful edition of a classic one can hardly remember to have seen; and the excellent scholarship of the editor deserves the sumptuous setting.

*Selections from Tibullus and Propertius.* By G. G. RAMSAY, LL.D. Oxford, Clarendon pr. 16°.

Professor Ramsay has long been favorably known by his edition of his father's commentary on Ovid, — a book that has become very popular in the classroom as a practical and judicious work. The present collection of selections from Tibullus and Propertius is therefore sure of a favorable reception, though the necessity of a second edition of Propertius so soon after the publication of Professor Postgate's admirable little book might be questioned. However, Mr. Ramsay has adopted a different principle of selection, and has in view a more mixed public than that for which Professor Postgate wrote his commentary.

*Caesar: book iv. of the Gallic war.* By C. BRYANS, M.A. New York, Macmillan. 24°.

The fourth book of Caesar's 'Gallic war' appears in a neat little volume by Mr. Clement Bryans of King's college, Cambridge. It contains a series of Caesar primers, books i., ii., and iii. having previously appeared. It contains a vocabulary, and a set of notes that are good in their way, though scarcely full enough for the lower forms of the schools, where such a book, no doubt, must find its most numerous purchasers.

*Livy: the last two kings of Macedon.* Selected and edited by F. H. RAWLINS, M.A. New York, Macmillan. 16°.

A thoroughly worthless and slovenly piece of work is the edition of that portion of Livy's history relating to the kings of Macedon, and culled from books xxxi.–xxxiv. by Mr. F. H. Rawlins. The editor represents a certain set of English scholars who have yet to learn that classical scholarship has advanced in many ways during the past fifty years; and that philology is a science, and not a game of guess-work. The notes to this volume show an amount of imagination, credulity, and complacent assumption of knowledge, that would be amusing but for the fact that some of the purchasers of the book may take it seriously, as entitled to respect. A single specimen nugget from the editor's attempts at philological discussion may serve to entertain the reader.

"*Luxuria*," says Mr. Rawlins (p. 133), "by its derivation, implies a divergence from the line of right. Similarly *scelus* is akin to σκολιός ('crooked')."

Now, this is all very pretty and ingenious, but unfortunately Mr. Rawlins has been misled by his desire for making etymology enforce a moral lesson, into a confusion of *luxus* from $\sqrt{\text{LAK}}$, with *luxus* from $\sqrt{\text{LUC}}$ or ultimately $\sqrt{\text{RIK}}$. On p. 122 he has not even a great ethical purpose to plead, in his attempt to explain *dubius* as cognate with βαίνω, βάσις. and hence rendered 'going two ways.' A few references to Corssen would have prevented such unnecessary errors as these, and many more besides.

H. T. PECK.

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## *TWO WORKS ON PEDAGOGY.*

THESE two books on the same subject, by experienced teachers, have, as might be expected, many points in common.

Both authors are well known in the educational world, Dr. Hewett being the president of Illinois state normal university, and Mr. White being the superintendent who has undertaken the re-organization and development of the Cincinnati public schools.

Both books are written after considerable experience in teaching, and both insist on basing pedagogy on psychology. This is the chief merit of each of these works. They tell us in unmistakable language that the day of empirical teaching is over, and that hereafter the teacher must know not only the subject to be taught, but also the pupil to whom it is to be imparted. While repeating that this insistence on psychology as the foundation of pedagogy is the peculiar merit of these books, yet we must add that in both, the psychological chapters are far less valuable than the strictly pedagogical. The authors would seem to have seen a fundamental truth in outline only: the power to develop it and grasp it in detail they show little evidence of possessing. Then, too, their psychological nomenclature and terminology are not always the best and most exact.

The pedagogical portions of these books, particularly Mr. White's, are very good. Mr. White deduces from psychology seven fundamental principles of teaching, which are these: 1°. Teaching, both in matter and method, must be adapted to the capability of the taught; 2°. There is a natural order in which the powers of the mind should be exercised, and the corresponding kinds of knowledge taught; 3°. A true course of instruction for elementary schools cuts off a section of presenta-

*A treatise on pedagogy.* By EDWIN C. HEWETT, LL.D. Cincinnati, Van Antwerp, Bragg, & Co. 12°.

*The elements of pedagogy.* By EMERSON E. WHITE, LL.D. Cincinnati, Van Antwerp, Bragg, & Co. 12°.

tive, representative, and thought knowledge each year; 4°. Knowledge can be taught only by occasioning the appropriate activity of the learner's mind; 5°. The primary concepts and ideas in every branch of knowledge must be taught objectively in all grades of school; 6°. The several powers of the mind are developed and trained by occasioning their natural and harmonious activity; 7°. In the teaching of any school art, clear and correct ideals should inspire and guide practice.

There seems to us to be more profundity in Mr. White's treatment of pedagogy than in Mr. Hewett's, and for that reason we recommend it rather than the latter. Mr. White's conception of the plan of methods in teaching is good, and he shows no disposition to push it beyond its legitimate limits. His chapter on teaching geography shows an acquaintance with the latest advances in that hitherto greatly neglected subject; and the syllabus of oral lessons on home geography brings out, in a way that any teacher ought to be able to appreciate, the points to be touched on in such a course, and their connection with each other. Mr. Hewett's book contains nothing so good as this, but it does contain a short passage on an entirely different subject which deserves quotation; for it presents a question now in the fore-front of all educational discussion. It is as follows: "Teaching can never become a profession in the same strict sense as law or medicine, so long as the majority of our schools are in session but for a few months in the year, and pay such small wages to the teacher; nor so long as the oversight of the work is committed to persons outside of the profession; nor so long as the majority of teachers follow the employment for a few years only. But the time may come when the person who makes teaching a life-work, and who brings to it the talent, energy, and special preparation which other professions demand, will receive all the respect and deference that are considered due to the members of other professions. How soon this time shall arrive depends chiefly on teachers themselves: there is no conspiracy on the part of the people to keep teachers below the position to which their worth entitles them, and it is the solemn duty of every teacher to make his full contribution to the sum of influences that shall raise teaching to the height it ought to occupy by virtue of its transcendent importance."

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THAT Prof. Clifford Lloyd Morgan of University college, Bristol, is about to publish a 'Text-book of animal physiology,' is an announcement that will give great pleasure to those who have followed his previous work, especially the lucid articles which occasionally appear in *Mind* over Professor Morgan's signature. The volume aims to satisfy the requirements of those who expect to pass the local examinations of Oxford, Cambridge, and London universities. Its first part deals with the anatomy and physiology of vertebrates, as exemplified by the frog, the pigeon and fowl, and the rabbit. In this part there are special chapters on histology, embryology, the genesis of tissues and organs, and animal metabolism. The second part is occupied with the structure and life-history of some invertebrate types; viz., the crayfish, cockroach, earthworm, liver-fluke and tape-worm, snail, fresh-water mussel, hydra, vorticella, and amoeba. Numerous outline woodcuts have been drawn specially for this work.

— The following is the report given by the *Athenaeum* of the paper on 'Recent psycho-physical researches,' read before the Aristotelian society on Feb. 21 by Dr. J. M. Cattell of Philadelphia. The lecturer said that "the present business of psychology seems to be to investigate the facts of consciousness by means of observation and experiment. As an example of the application of scientific methods to the study of mind, he gave an account of experiments he had made on the limits of consciousness and the time taken up by mental processes. It is possible to measure with great accuracy the time we need to perceive, to will, to remember, and to think. These times are quite constant: we can find to the hundredth of a second how long it takes to see the color blue, or to call to mind that Paris is in France. We thus find that a word can be seen in about the same time as a single letter, that some letters are more difficult to see than others, and get other facts which have practical and educational bearings. They are also of theoretic interest. Life is not measured by the years we live, but by the breadth and rapidity of our thoughts. Besides determining the rate at which we think, such experiments in other ways throw light on the nature of thought, and help us to put the facts of mind into the great order which is the world."

— Professors Horsley and Schäfer recently presented a paper to the Royal society, on some experiments made by them upon the functions of the cerebral cortex. Professor Horsley has within a year operated upon thirteen patients, in ten cases removing portions of the brain and in three cases portions of the skull. In these experiments he used precisely the same anaesthetics and antiseptics as he had employed in his experiments upon the brains of monkeys, and in no case had the patient complained of any pain being caused by the operation.

# SCIENCE.

FRIDAY, APRIL 22, 1887.

## COMMENT AND CRITICISM.

THE AMERICAN ASSOCIATION for the advancement of science has decided to hold its thirty-sixth meeting in New York City during the week beginning Aug. 10, 1887. It therefore becomes the duty and privilege of the scientific and educational institutions of the city and vicinity to provide for the meeting in a manner which shall be creditable alike to themselves and to the metropolis. The Academy of sciences, having been asked to take the initiative in the matter, has appointed a committee of conference to secure concert of action among the several institutions. A meeting will be held at the Hotel Brunswick, at 8 o'clock, on the evening of Friday, April 29. The special work before this conference will be the consideration of ways and means, and the formation of permanent committees, which, united, shall constitute a local committee for the meeting of the association. This great national gathering of scientists will be an important event in the history of our city, and should mark an epoch in the development of scientific interest in the community. It is highly desirable, therefore, that the association should find a cordial welcome, and should receive a kind and degree of interest and hospitality worthy of the great metropolis.

THE CENTENNIAL ANNIVERSARY which Columbia celebrated last week, following so closely Harvard's two hundred and fiftieth birthday, is significant of the fact that our larger institutions of learning are growing old. They are evidences of the wisdom of their founders, who, amid all the turmoil and care of opening up a new country to civilization and of developing fitting forms of government, found time to lay the foundations for what have since become the leading colleges and universities of the country. Columbia's centennial was more or less fictitious, since the original charter to King's college bore the date 1754; and the annual commencement in June next is the one hundred and thirty-third. The celebration was really, as the official bulletin announced, of the hundredth anniversary of the "revival and confirmation of the original charter by the legislature of the state of New York." There is much in Columbia's history and in its personal associations to make it peculiarly the college of the city of New York. As Mr. Coudert pointed out in his admirable oration, Columbia has grown with the city's growth, and flourished with the city's prosperity. The prominent men of New York, from Alexander Hamilton and John Jay and DeWitt Clinton to Hewitt and Dix and Agnew and Woodford, are numbered among its alumni. Its influence, though ultra-conservative, has been, on the whole, for good. Under the enlightened presidency of Dr. Barnard, the policy of the college has become more liberal and aggressive, and to-day it is doing far more for the community than it has ever done before.

Having come so far and done so much, the question is naturally raised as to its future development. The public press is urging that the college, with its associated schools of applied science, of medicine, of law, and of political science, should organize itself into a genuine university, and offer those opportunities for advanced instruction and research which its faculties and its situation are so well fitted to provide. The very obvious answer to this is that such a scheme requires large amounts of money; and Columbia has in the past been the recipient of almost nothing, while Harvard, Cornell, and Princeton have had gifts in abundance showered upon them. Columbia is struggling under a heavy debt, and, until that is removed, entrance upon a university career is impossible. Furthermore, its equipment is far from complete. It needs a physical and a biological laboratory, a department of comparative philology, additional provision for historical science, an enlargement of the ludicrously small philosophical department, and, more than all, a library fund which will provide for the book purchases that ought to be made. All these are things not known, perhaps, to those who are clamoring for a university, that serve as an effectual barrier to university development. They are details well known to Columbia's management and alumni, but only made public by the discussions consequent upon the recent

centennial celebration. The friends of the college are in hopes, that, now that these obstacles to rapid development are made known, they may be speedily removed.

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A MOVEMENT HAS BEEN STARTED to found a laboratory on the New England coast, where students, teachers, and investigators may find facilities for the pursuit of biology. It is now some years since the brief episode of the Penikese laboratory, which was founded by Mr. Anderson and intrusted to Professor Agassiz. During the interval, summer schools of science have multiplied, and a few of them have successfully maintained their modest usefulness. Of these, one of the most prosperous as well as most needed was the seaside laboratory established at Annisquam, near Cape Ann, six years ago, by the Woman's education association, with the co-operation of the Boston society of natural history. It has given instruction to no less than 102 students, men and women from many states, who were for the most part teachers. The instruction has been almost wholly gratuitous, and the equipment of the laboratory meagre ; but the opportunities offered have been sought and prized. As the association does not give permanent support to any of its enterprises, and as its committee in charge of the laboratory was convinced of its utility, they sent a circular letter to teachers of science in different parts of the country, giving an account of the work done, and asking for opinions as to the need of such an institution. The letters received were full and explicit, showing a deep interest in the project of founding a seaside laboratory of broader scope. The committee then called a meeting, at which there was a large attendance of naturalists, the majority being officers of New England colleges. At this meeting the discussion showed a unanimous approval of the work begun at Annisquam and an emphatic resolution to extend and perfect it. To execute this resolution, a committee was appointed with full powers to establish a laboratory on an improved and permanent foundation. This committee, which consists of Prof. Alpheus Hyatt, (chairman), Prof. S. F. Clarke, Mr. John Cummings, Dr. W. G. Farlow, Prof. E. L. Mark, Miss S. Minns, Dr. C. S. Minot, Prof. W. T. Sedgwick, Mrs. C. C. Smith, Mr. B. H. Van Vleck, Mr. Samuel Wells, and Miss A. D. Phillips (secretary), is endeavoring to raise fifteen thousand dollars, half the sum to be used for the land, building, and equipment, the other half to be applied as a guaranty fund for the expenses during five years. It is to be hoped that all those will respond liberally to this appeal, who are interested in improving the methods of education and in contributing to the advancement of science. Subscriptions may be sent to any member of the committee, or to the treasurer, Mr. Samuel Wells, 31 Pemberton Square, Boston, Mass.

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The advantages of the prospective laboratory are manifold. The demand for natural-history teaching has rapidly increased in America. Colleges and schools are seeking teachers competent to give instruction in botany and zoölogy ; but teachers have difficulty in fitting themselves in these sciences, because they lack opportunity to obtain suitable training. An additional obstacle to the thorough and practical study is, that many of the most important types of plants and animals are exclusively marine, having no inland representatives. It is impossible to give good biological instruction without immediate familiarity with the principal types of living organisms. The new laboratory is intended to offer practical training in biology with special reference to marine forms. It is hoped that its work in this field will render it a valuable factor in education. The laboratory will also supply collections and materials for class-work to schools and colleges. Advanced workers and specialists will have facilities such as have not existed in this country hitherto, although they have been available in the different biological laboratories sustained by Germany, France, Austria, Italy, England, Scotland, Holland, Sweden, and Russia. The inestimable benefits which have ensued from the discoveries of biologists, and the profound influence of their science upon modern thought, fully justify the attempt to found a laboratory for biological investigation. The experience of the marine stations in Europe, of the summer school at Annisquam, Mass., referred to above, and of the more southern laboratory of the Johns Hopkins university, have established beyond dispute the great value to education and to science of such institutions. The proposed plan of the laboratory, which will be opened this summer if the necessary means are obtained, may be briefly described so far as settled. The management will be intrusted to the following board of trustees : Prof. W. G. Farlow, Miss Florence M. Cushing, Prof. Alpheus Hyatt, Dr. Charles S. Minot, Miss Susanna Minns, Prof. William T. Sedgwick, Samuel Wells, Esq. It is

intended to secure a location at a point on the New England coast where the fauna and flora are abundant and varied, and the cost of living moderate; to build a laboratory with two stories, the lower story having accommodations for teaching twenty-five persons, the upper story having work-places for investigators; to furnish aquaria, microscopes, microtomes, glassware, etc., and a constant supply of water for aquaria; also to have a convenient landing, boats, collecting-apparatus, etc. Of course, to insure the permanency and full usefulness of the laboratory, a considerable endowment fund must be ultimately obtained, but so much can perhaps not be hoped at the start.

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PASTEUR, who is now sixty-four years old, was last winter sent by his physician to Italy for his health, and is only just returning to Paris. Under date of April 1, in a letter to his friend Mr. Jules Marcou of Cambridge, which the latter kindly permits us to use, he writes from Arbois in the Jura that he hopes to live to welcome the earliest publications of the Institut Pasteur, and adds, "We have just purchased eleven thousand square meters of land, and the subscription has reached the sum of nearly two million francs; it is, however, very insufficient, for, if we spend twelve hundred thousand on land and buildings, the income from the remainder will be much too small. Oh! if only some American millionnaire were inspired with an enthusiasm for this work! I hope that when we are incorporated, and this will be soon, we shall be better endowed. We shall then be able to receive legacies. To proceed suitably and with full independence, we should have, according to my estimates, three and a half million francs. I am confident. The future is ours. The prophylactic treatment of rabies continues to do well. Very, very rarely are there failures, and all in cases where exceptional circumstances appear. There has been but one failure since the first of January and more than five or six hundred cases treated, a multitude having been most severely bitten. If we could only attack diphtheria, phthisis, etc., with success. We are going to attempt it. It is at least a step toward discovery to have confidence, and to hope in the result of obstinate labor."

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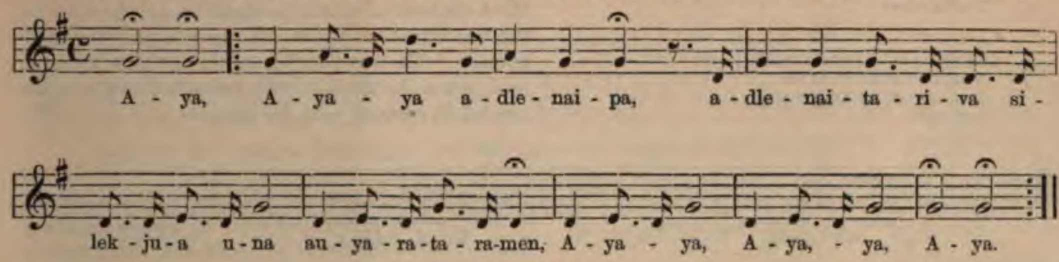
## *POETRY AND MUSIC OF SOME NORTH AMERICAN TRIBES.*

ETHNOLOGISTS are well acquainted with the fact that there is no people and no tribe that has not some kind of poetry and music, but the study of this branch of aboriginal literature has hardly been begun. We will give here a few examples of aboriginal poetry which will show that the mind of the native enjoys as well the beauties of nature as we do; that he expresses his grief in mournful songs, and appreciates humorous conceptions. No people is more fond of music than the Eskimos, the inhabitants of the extreme north. Though most explorers affirm that their music is nothing but a monotonous humming, the following tunes and texts, which were collected by me in Baffin Land, will show that this is not true. Here is a song describing the beauties of summer:—




Only the first line is given in the Eskimo language. The translation is, —

"Aya!
Ayaya, it is beautiful, beautiful it is out-doors when the summer comes at last.
Ayaya, ayaya, aya!

Ayaya, it is beautiful, beautiful it is out-doors when the reindeer begin to come,
Ayaya, ayaya, aya!

Ayaya, when the roaring river rushes from the hills in summer.
Ayaya, ayaya, aya!

Ayaya, there is no reason for me to be mournful when the gulls cease crying.
Ayaya, ayaya, aya!

Ayaya, plenty of meat I shall have and plenty codfish.
Ayaya, ayaya, aya!

Ayaya, it is beautiful, beautiful it is out-doors when the summer comes at last.
Ayaya, ayaya, aya!"

It was in the midst of winter that I heard this song for the first time. After a long and lonesome journey over the ragged highlands which form the west coast of Davis Strait, almost exhausted by want of food and the exertions of driving and hauling the heavy sledge over rocks and steep snow-banks, we had arrived on the coast of Davis Strait, and struck a track that led to the Eskimo village. No white man had ever visited this part of the coast, and, the men being out hunting, the women and children, who had frequently heard of the *Kadlunait* ('the whites'), rushed out of the huts when they saw the sledge coming with an unknown dog-team and an unknown driver. When they discovered him to be a white man, their excitement reached the highest pitch, and they burst out in a wild dance and chorus, singing the joyful song of summer. This song was the most popular one at the time. It was composed by an Eskimo living farther north, 'Snowwind' (*Kenningnang*) by name, and had spread rapidly over all the settlements.

This man belonged to a family of poets. His nephew, Utityak, had composed a well-known satirical song. One fall, when hunting on the ice, a strong gale set in, and the ice broke up, separating the unfortunate youth from the land and from his companions. Several days he drifted on the floe at the mercy of the winds. Heavy snow-falls covered the drifting ice, the swell broke up the floe, and death stared at him continually. Yet he did not despair, nor even lose his temper, but, in mockery of his own misfortune, he composed the following song: —



"Aya!
It's glorious on the ice!
Here it's nice!
Behold my lonesome path,
All snow and slush and ice!
This is nice!

"Aya!
It's glorious on the ice!
Here it's nice!
Behold my native land!
It's snow and slush and ice!
This is nice!

"Aya!
Awaking from my slumbers in the dawn,
Monotonous fields of ice
And gloomy lanes of water
I behold.

"Aya!
Oh, when I reach the land
It will be nice.
When will this roaming end?
When will I be at home?
Then it's nice!"

Besides these modern songs, the Eskimos have many ancient ones, some of which are incantations, while others form part of the old traditions. Most of these are mere recitativos, as the song of the boy who was stolen by the sea-monster Kalopaling. He was playing on the ice near a crack, and when he saw a man and a woman who intended to recover him, he sang, —

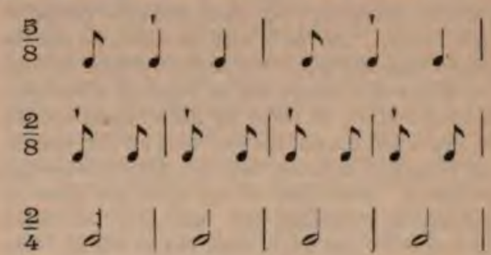

i.e., 'Two men are coming, one with a jacket, the other with a bird-skin dress;' upon which Kalopaling came and took him to the bottom of the sea. Some other songs are lullabies, or sung while playing ball.

During the festivals, singing is one of the principal amusements. Duels in singing are fought, each man trying to outdo the other. Then the singer strips off his jacket, takes the hand-drum, the edge of which he beats with his wrist or a small drum-stick, and, swinging his body according to the rhythm, sings the song he has composed for the purpose, or mocks his opponents by praising his own exploits and skill, and making fun of their awkwardness and laziness. Then the women, who sit nearest the wall of the snow-hut, join the chorus, 'Aya, aya,' while the men sit silent, and, as their turn comes, take the stand.

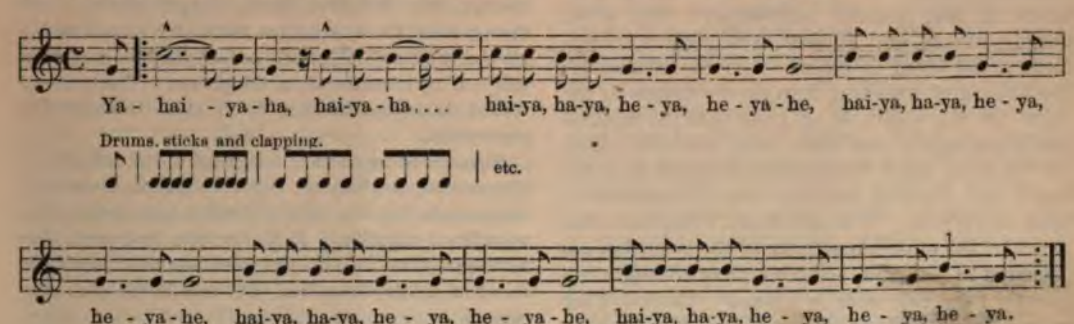
The Eskimos have two different types of tunes, the one corresponding to our major, the other to our minor key. In the first group the fourth is wanting, the scale being in reality identical with the wide-spread one : c, d, e, g, a. The minor key has the following notes : B, c, d, e flat, f, g.

We will give a few tunes from another country, belonging to a people of widely different ethnological character. The author collected them among different tribes of Indians of British Columbia. While the Eskimo prefers the solo chant, these Indians either sing the whole song in chorus, or have some kind of responsorium, the first singer singing the whole text, while the rest join in a refrain or in the second half of the verse. As the rhythm is very complicated, and keeping time is one of the principal demands of the Indian chorus, a singing-master, who instructs the men, is found in every village. In the fall, before the time of festivals begins, he gathers the men about him every day, and walks up and down the street of the village, teaching them to sing the tunes which are used at the winter dances and at other feasts.

The scene of a feast is extremely picturesque. Along the elevated bench, which is built along the walls of the large wooden house, mats are spread, upon which the guests who are invited to partake in the feast sit down, wrapped up in their cedar-bark or woollen blankets, which they wear as the Romans wore the toga. The long raven hair is kept back by a gay kerchief or a piece of skin tied round the head. One man has the large drum, which is a good-sized box of bent-wood with the host's crest painted on the side ; several others have carved sticks for beating the time. In the middle of the house a blazing fire is burning, in which stones are heated, to be thrown into the large wooden kettles, thus making the water boil for cooking the meat. When all the guests are in, four songs are sung before dinner can be served. The time is beaten with the drum and the carved sticks, the rest of the men clapping their hands. At the large winter festivals the rhythm of these four songs is prescribed by long usage. The bars of the first are in five-eighths time ; two have a fast movement ; the last one is solemn and slow :—



The rhythm of the songs themselves is very irregular. Here is an example : —




The text of some songs of these Indians is highly poetical, as that of the following responsorium, — a mourning song that moves in a slow and solemn rhythm. A chief who had lost his child sings, and the mourning tribe respond.

*Chief.* — Don't mourn any more, don't mourn.
*Chorus.* — We do not mourn any more.
*Chief.* — He went up to play with his brethren the stars. Don't mourn any more.
*Chorus.* — We do not mourn any more.
*Chief.* — There he is hunting with the hunters the nimble deer.[1] Don't mourn any more.
*Chorus.* — We do not mourn any more.

[1] Hunters and deer are constellations.

*Chief.* — We will see his beloved face in the new moon. Don't mourn any more.
*Chorus.* — We do not mourn any more.

In another mourning song, the people, lamenting the death of a great chief, sing, "He fell, the pillar of heaven, and, falling, crushed all our joys."

These few examples will show that the mind of the 'savage' is sensible to the beauties of poetry and music, and that it is only the superficial observer to whom he appears stupid and unfeeling.

DR. FRANZ BOAS.

## *LONDON LETTER.*

THE case of M. Chauffat, a native of Haute Savoie, who has been overtaken by a trance in a French hotel in London, has been exciting very great interest among the section of medical men devoted to psychological studies. To-day is the seventeenth day of his cataleptic condition, from which he shows no sign of awakening, and the administration of food is not a little difficult. Chauffat has been a patient of the famous Dr. Charcot, in the Salpetrière hospital in Paris, where a large number of experiments are now being conducted upon hypnotizing. Dr. Charcot, however, particularly wishes it to be understood that Chauffat is not a hypnotized subject. The general state of his body is good, the temperature and pulse being normal, though the respiration is subject to great variation, changing from 15 to 28 in the course of a few hours. The only way in which he can be aroused sufficiently for the administration of food is by directing a strong ray of light on to his eyes. An examination of them by the eminent oculist, Mr. Brudenell Carter, showed that all the vessels, both veins and arteries, were much contracted and very small. Both sides of the body are alike in their condition, though the cataleptic condition is stronger in the limbs than in the trunk. The most extraordinary feature of the case is the remarkable results obtained by gently stroking Chauffat's arm. The limb, if raised upright, remains in that position indefinitely; and, when certain nerves are stroked, the fingers clinch tightly, the blood is forced from the extremity, the hand and fore-arm turn slowly round to the right till the strain is so great that the muscles stand out rigidly, the limb being perfectly rigid. On the other hand, the most gentle touch or stroking of the flexor of the fore-arm is sufficient to relax the whole. Without doubt, Chauffat's case is one of the most remarkable of the kind that has occurred in England, although they are more frequently to be met with in France. The following extract from the Proceedings of the Royal society of Edinburgh for Feb. 19, 1816, has recently been published, and has an interesting bearing on the case.

"Dr. Brewster communicated an account of the sleeping woman of Dunninald, near Montrose, drawn up by the Rev. James Brewster, minister of Craig. Margaret Lyall, aged 21, daughter of John Lyall, laborer, of Dunninald, was first seized with a sleeping fit on the 27th of June, 1815, which continued to the 30th of June; next morning she was again found in a deep sleep — in this state she remained for seven days, without motion, food, etc.; but at the end of this time, by the moving of her left hand and by plucking at the coverlet of the bed and pointing to her mouth, a wish for food being understood, it was given her. This she took, but still remained in her lethargic state till Tuesday, the 8th of August, being six weeks from the time she was seized with the lethargy, without appearing to be awake, except on the afternoon of Friday, the 30th of June. For the first two weeks her pulse was generally about 60, and previous to her recovery at 70 to 72. Though extremely feeble for some days after her recovery, she gained strength so rapidly that before the end of August she began to work at the harvest on the lands of Mr. Arkley, and continued without inconvenience to perform her labour.

"The account is drawn up by the clergyman of the parish, and is accompanied with the medical report of the surgeons who attended; to whose attestations are added those of Mr. Arkley, the proprietor of Dunninald, and Lyall, the father, and is in every respect entitled to the fullest credit."

The term 'hypnotism' was first introduced many years ago, by Mr. Braid, a surgeon of Manchester, to whom the demonstration of the condition was first due. An account of his work is given in Dr. W. B. Carpenter's 'Mental physiology,' pp. 601–610. The subject has very recently been revived, and has formed the subject of several curious experiments in the Salpetrière hospital and elsewhere. According to the *Zeitschrift für Elektrotechnik*, experiments have shown that there was no difficulty in producing all the ordinary hypnotic effects upon a distant subject by means of a telephone. The present writer, however, has not been able to verify the statement.

Rumors of important telegraphic and telephonic discoveries come to us from Belgium, as having been made by von Rysselberghe, but details are at present wanting. It is certain, however, that arrangements are in progress for the establishment of a telephone-line between Paris and London.

At the Colonial conference now assembled in London, some striking facts were put forward by Mr. Pender, chairman of the 'Eastern telegraph company,' as to the debt which commerce owes to science. Twenty years ago there were scarcely 2,000 miles of submarine cables: now there are 107,000 miles, of which all but 7,000 are under British control (the total cost being $185,000,000); and "cables can at the present time be laid with comparatively little risk of breakage, and with an almost certainty of efficient repair." The total land-lines are estimated at 1,750,000 miles, costing $260,000,000. W.

London, April 9.

## EXPLORATION AND TRAVEL.

### *The Stanley expedition and Emin Pasha.*

While Stanley is proceeding up the Kongo to relieve Emin Pasha, news has been received that the latter is safe and well, though unable to leave his province. A Somali trader from Uganda has arrived at Zanzibar, confirming former news that Emin Pasha was established at Wadelai. He had two small steamers plying on the White Nile and on Lake Mvutan. In November, four months later than the advices brought by Dr. Junker, Emin Pasha visited the capital of Unyoro, which is situated on the north-west shore of the Albert Nyanza. He was accompanied by Dr. Vita Hassan, ten Egyptian officers, three Greeks, and four negroes. From there he sent a message to Mwanga, the young king of Uganda, requesting an audience. The king consented to receive him if he came without his followers, and Emin Pasha thereupon went to him, accompanied by Dr. Vita Hassan and the three Greeks. After he had staid seventeen days with the king, he asked for permission to pass through his territory toward Zanzibar; but Mwanga, upon hearing this request, ordered them to return the way they came. The Somali who made this statement says that the messengers despatched from Zanzibar to inform Emin Pasha that Stanley had gone with an expedition by way of the Kongo to rescue him, were detained in Unyanyembe. The frequent news from Emin reaching us by way of Zanzibar encourages us to hope that he will succeed in leaving the district in which he is now imprisoned.

Meanwhile Stanley is proceeding by the Kongo route, and Tippo-Tip's couriers are on the way to Stanley Falls in order to make preparations for the northward journey. Stanley's observations and plans are set forth at some length in two letters from Zanzibar published in the London *Times*. On leaving Zanzibar on board the Madura, his expedition numbered 709 men. The contract he made with Tippo-Tip is of considerable interest. He found this enterprising trader to be of far greater importance than in 1877, when he escorted Stanley's caravan to the Kongo. It is practically in his power to close the roads leading from the east coast to the upper Kongo. Stanley engaged him and his followers to accompany him from Stanley Falls to the region north of Lake Tanganyika, and to have the ivory belonging to Emin Pasha — which, according to Dr. Junker, amounts to seventy-five tons — carried back to the Kongo. But, besides this, he has appointed him governor of the Stanley Falls station, which was lost to the Arabs some time ago. It will be remembered that the object for which the station was established was to prevent the Arabs from extending their influence farther down the Kongo. Since the loss of the station, they descend the river, and are said to have reached the Bangalla station. Tippo-Tip's duties will be principally to defend Stanley Falls, in the name of the state, against all Arabs and natives. The flag of the station will be that of the state. At all hazards, he is to defeat and capture all persons raiding the territory for slaves, and to disperse all bodies of men who may be justly suspected of violent designs. He is to abstain from all slave traffic below the Falls himself, and to prevent all in his command from trading in slaves. In order to insure a faithful performance of his engagements with the state, a European officer is to be appointed resident at the Falls. By this contract, the upper Kongo is actually surrendered to the Arabs, for those Arabs who were to be prevented from descending the Kongo beyond Stanley Falls are Tippo-Tip's men, who, to be sure, will not abstain from the profitable slave trade on the Kongo, as demanded by this contract. Stanley's action, and Baumann's description of Stanley Falls in the Proceedings of the Geographical society of Vienna, show that the Arabs are actually the masters of the upper Kongo, and that the Kongo Free State is utterly powerless there.

As the fate of Emin Pasha forms the central point of interest in Central Africa, some biographical notes may be welcome. According to Dr. Wolkenhauer (*Deutsche geogr. Blätt.*, 1887, No. 1), his name is Eduard Schnitzer, not Schnitzler, as he was generally called. He was born at Oppeln, in Prussian Silesia, in 1840, but his family removed soon after his birth to Neisse. After having gone through the gymnasium of that town, he studied medicine at the university of Breslau, and passed his examinations, about 1864, at Berlin. His favorite studies from early boyhood were natural sciences, more particularly zoölogy, and he had always longed to visit foreign countries. Having passed his examinations, he went to Turkey, and was appointed physician of the district and port of Antivari. In 1870 he became attached to the household of Ismael Hacki Pasha, whom he followed to Trebizond, Erzerum, Constantinople, and Yanina. When his patron died, toward the close of 1873, he accompanied his family to Constantinople. After a short visit to Germany in 1875, he returned to the Orient, and obtained an appointment as surgeon in the Egyptian army. Subsequently he served under Gordon Pasha, who appointed him surgeon-general, and, in 1878, governor of the Equatorial Province. His principal researches, besides his explorations and the administration of his province, were ornithological; and

among his collections which were sent to Germany are twenty-six new species. It is to be hoped that the gallant explorer will soon be saved from his perilous position, and succeed in taking with him his collections and the valuable results of his many years' researches in equatorial Africa.

*Asia.*

The observations of E. Michaelis on the signs of an ice-period in the Altai Mountains, mentioned in *Science*, Feb. 11, 1887, are confirmed by A. Bialoveski, who found glacier deposits, remains of moraines, and glacial striae in the southern part of the Altai (*Nature*, March 31, 1887).

*La gazette géographique* says that Sarat Chandra Das, an Indian explorer, who was sent out by the English government in order to study the religions of Indo-China, has arrived at Bangkok. He pretends to have explored the upper course of the Bramaputra and Jamdok-Tso (Palte Lake), which is situated about fifty miles south of Lassa.

*Africa.*

The new expedition of Lieutenant Wissmann left Luluaburg Nov. 16, 1886. The proposed field of exploration is the district between the Sankuru and Nyangwe. He went by steamer to the place where the Lubi discharges into the Sankuru. From there he will try to go north and to explore the unknown region where the Lulongo, Juapa, and Lomami have their sources (*Mouv. géogr.*, No. 7). During his stay in Luluaburg, Wissmann was not idle. He and de Macar, the new commander of the station, made a reconnaissance in the land of the Baluba and the basin of the Lubilash. They visited the residence of Mona Tenda, near the river Lukula. The country is inhabited by the Bashilange, and densely populated, the villages being built on the summits of the hills. The eastern bank of the Lukula belongs to the Baluba. While the country west of the river is very fertile, the Baluba country forms an undulating prairie. Though its appearance is barren and desolate, the population is very numerous. Unfortunately the visitors were attacked by the natives and forced to return to Luluaburg (*Mouv. géogr.*, No. 7).

In his letter to the London *Times*, Stanley criticises the methods of colonization of the Germans in eastern Africa. He advises them to penetrate the Somali peninsula instead of establishing scattered stations in the most unhealthy regions of equatorial Africa. He proposes that they should establish a permanent post or fort at the mouth of the Jub or Rufiji, and advance by degrees inland. In fact, the German East African association follows a similar course to the Kongo association by establishing factories on the coast and inland. The district they selected for their operations is one of the most important in Africa, and includes all the caravan routes from the upper Kongo and Nile to the harbors of the east coast. Stanley's observations in Zanzibar on the predominant influence of the Germans and the decreasing power of the English do not confirm his criticism.

*America.*

The Brazilian and Argentinian commissions for determining the disputed boundary of the territory of the Missions were going to meet in the beginning of April. Important additions to our knowledge of the geography of that district may be expected from their surveys.

*Antarctic regions.*

The cable informs us that Nordenskjöld is planning an Antarctic expedition, and that he assumes eighteen months for accomplishing it. The interest in Antarctic exploration is rapidly increasing everywhere. The Royal geographical society of London, the Scotch geographical society, the German Geographentage, the Australian royal society, have expressed themselves in favor of Antarctic explorations, but since Lieutenant Bove's unsuccessful journey, this is the first attempt of organizing an expedition.

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## *NOTES AND NEWS.*

THE Elizabeth Thompson science fund, which has been established by Mrs. Elizabeth Thompson of Stamford, Conn., "for the advancement and prosecution of scientific research in its broadest sense," now amounts to $25,000. As accumulated income is again available, the trustees desire to receive applications for appropriations in aid of scientific work. This endowment is not for the benefit of any one department of science, but it is the intention of the trustees to give the preference to those investigations *which cannot otherwise be provided for*, which have for their object the advancement of human knowledge or the benefit of mankind in general, rather than to researches directed to the solution of questions of merely local importance. Applications for assistance from this fund should be accompanied by a full statement of the nature of the investigation, of the conditions under which it is to be prosecuted, and of the manner in which the appropriation asked for is to be expended. The applications should be forwarded to the secretary of the board of trustees, Dr. Ç. S. Minot, Harvard medical school, Boston, Mass., U.S.A. The new grants will probably be made in May, 1887. The following grants have been made: 1. $200 to the New England meteorological society for the investigation of

cyclonic movements in New England; 2. $150 to Samuel Rideal, Esq., of University college, London, England, for investigations on the absorption of heat by odorous gases; 3. $75, to H. M. Howe, Esq., of Boston, Mass., for the investigation of fusible slags of copper and lead smelting; 4. $500 to Prof. J. Rosenthal of Erlangen, Germany, for investigations on animal heat in health and disease; 5. $50 to Joseph Jastrow, Esq., of the Johns Hopkins university, Baltimore, Md., for investigations on the laws of psychophysics. The board of trustees consists of H. P. Bowditch, president; William Minot, jun., treasurer; Francis A. Walker; Edward C. Pickering; Charles Sedgwick Minot, secretary.

— The fish-commission schooner Grampus, recently finished, has been engaged during the winter in catching cod-fish and gathering cod-eggs, and also in catching mackerel. It is the purpose of the commission to study the migrations of the mackerel from its first appearance until it enters the Gulf of Maine. The seasons and conditions favorable to spawning will be closely observed. The migrations of menhaden, blue-fish, and other fishes, will also be studied.

— The conference of astronomers called by Admiral Mouchez, director of the Paris observatory, for the purpose of forming a plan of co-operation in photographing the whole sky, will doubtless result in the accomplishment of this project. The proposition is to enlist ten or twelve observatories in the undertaking, so located that their combined range will take in the whole sky. It is suggested that each plate be four degrees square, which if adopted, would require eleven thousand plates. It is estimated, that, with an average of one hundred plates per year from eleven observatories, each plate covering four degrees square, it would take ten years to complete the whole work.

— We learn from the *Athenaeum* that the Hibbert lecturer this year will be Professor Sayce, and the subject will be Assyrian and Babylonian religion. The lectures will be delivered at the end of April and during May, both in London and Oxford. The Hibbert trustees have also in the press a work by one of their scholars, Mr. H. W. Wallis of Cambridge, 'On the cosmology of the Rig Veda: a study in Indian logic.'

— Rev. W. Lucas Collins, editor of the popular series of 'Ancient classics for English readers,' is dead.

— Professor Möbius of Kiel is the new director of the Zoölogical museum at Berlin.

— Messrs. B. Westermann & Co., New York, have published a second edition of Lemcke's "An illustrated grammar of skat, the famous German game of cards now attracting so much attention."

— Entrance examinations for the Massachusetts institute of technology will be held in Boston, Mass., on Thursday and Friday, June 2 and 3; also in New York, Philadelphia, Montreal, Chicago, St. Louis, Cincinnati, San Francisco, Washington, Nashville, St. Paul, Atlanta, and Pittsburgh.

— The *Lancet* reports the case of a woman dying from myxedema whose temperature ranged from 66° F. to 76° F., the normal temperature being 98.5° F. The pulsations of this patient's heart were 36, and her respirations 12 to the minute. The temperature is said to be the lowest human temperature on record.

— The *New York medical journal* of April 9 contains a detailed account, with illustrations, of the induction balance and the telephonic probe employed for the detection and location of metallic masses in the human body.

— The *Boston medical and surgical journal* reports that a large number of calves from one hour to three days old are said to have been slaughtered in Herkimer and Oneida counties, and sent to New York, where they are put up as 'canned chicken.'

— From the report of the hospital for Chinese, in Shanghai, we learn that in China small-pox inoculation is still in vogue. For this purpose a rag is moistened with the variolous matter and placed in the nostril. That the disease is prevalent in China is easily understood after this explanation.

## LETTERS TO THE EDITOR.

****The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Mole-lore.

HERE are three items of mole lore in the District of Columbia: —

1. A mole's feet cut off and hung around a child's neck will help it in teething. In some instances in Virginia these odd amulets have been handed down, I am told, for generations. They are equally believed in by colored people of Maryland. 'That's what the old-time people say,' is the only explanation. The superstition comes into the District from both these neighboring states.

2. Once the mole was an over-proud young lady. She is condemned to travel under ground as a punishment for her pride. Unlike the former, this is told with a smile, and probably quite without belief.

It will be readily recognized as a myth of wide dispersion. Perhaps the delicate fur and the grovelling habits of the little animal account for it.

3. Once the mole had eyes like other animals, but no tail. He met a creature which ridiculed him for his poverty in this latter respect. The derision preyed on his mind, and, when he met a being who could help him, he petitioned for aid. He was told that he must give up his eyesight 'So he sold his eyes for his tail.' W. H. BABCOCK.

Washington, D.C., April 16.

## Some hardy buds.

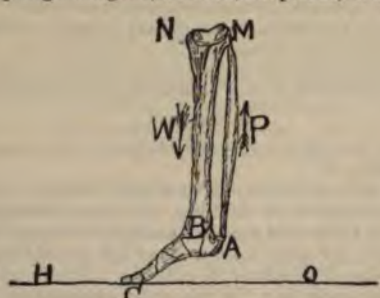
While in the country two weeks ago, my wife cut some branches from a pear and a cherry tree, and also from a lilac-bush, and brought them to the city. At that time the buds looked as they had all winter; in fact, we thought the pear cutting was dead. In a few days the buds commenced to open, and to-day the cherry-blossoms are out, as they would be on the tree, the blossoms of the pear are just opening, and those of the lilac are beginning to show. The water in which they were placed has been changed daily, and the cuttings kept in the sun as much as possible. It has occurred to us that such cuttings might be placed in rooms where there are invalids, both in homes and in hospitals, and give the sick a taste of the country which they could otherwise not get. It is no less an object of interest and instruction to the well: the daily, and I might say hourly, changes in the buds as they unfold are fascinating to watch, and even those whose lives have been spent in the country have never seen the gradual development of the blossoms as they can thus see them on the severed branches. J. H. R.

Brooklyn, April 8.

## On tiptoe.

While feeling honored that the attention of so eminent a physicist as Professor LeConte should be attracted to the question which has been recently discussed in *Science* under this heading, it still seems to me, as it did when I called the attention of Professor Van Dyck to the matter, that the lever is of the first order,

Professor LeConte quietly assumes that the point $C$ (adopting his figure, *Science*, ix. p. 341) is the ful-




crum, but just there is the question. Suppose a person sitting down to put his toe against some object, and, by the same muscular action which raises the body on tiptoe, to push the object away. Here the case is evidently a lever of the first class, the fulcrum being the ankle-joint ($B$), and the weight the point of the toe's pressure ($C$).

Now suppose, that, in precisely the same way, he presses his toe against some firmer object, as a wall, and, instead of pushing it, pushes *himself* away.

I fail to see how it is other than an unnecessary complication, at least from a physiological standpoint, to suppose the fulcrum and weight to change places, so as to make the lever one of the second class. Further, in cases where the result is partially a movement of the object, and partially of the person's body, — as in rising on tiptoe upon a yielding object, — the complication of the solution upon the hypothesis that the lever is of the second class is further increased; whereas in every case, since the foot still turns upon the ankle-joint $B$, by regarding it as a fulcrum and the lever as of the first class, the conclusion reached by Professor LeConte, that $P : W :: CB : AB$, becomes an evident application of the general law of mechanics. EDWIN J. POND.

Austin, Tex., April 12.

## Winds in Denver.

H. A. Howe, in *Science*, No. 216, asks "why winds blow at Denver from the north during the day, and from the south at night."

It is for these reasons: Denver is in a cañon running north (the mountains on the west, a slight elevation on the east, and a 'divide' on the south), through which flows Cherry Creek. Now, winds *invariably* blow up cañons during the day, and down them at night. This brings the question to, "Why do winds blow up cañons during the day, and down at night?" which I take to be the intended interrogatory. During the day, the sun heats the air, which, becoming light, rushes up the cañons, while at night the air becomes cool and seeks lower altitudes. Of course, the disturbed equilibrium increases the wind's velocity. I think I have crudely answered the question. F. F. WYMAN.

Silver Reef, Utah, April 7.

## Geographical centre of the United States.

If an area or district of country is mapped on a projection of small areal distortion, the geographical centre of the area may be defined to be the centre of gravity of the figure.

The problem to determine the centre, would, under this definition, resolve itself into the question of determining the centre of gravity of a plane figure of irregular outline. Of the various ways in which the centre of such an area may be found, the mechanical ones are perhaps of easiest application, and, on the whole, yield the most satisfactory results.

One method consists in tracing the outline of the area whose centre is to be determined, on stiff cardboard, then cutting out the figure along the boundary so traced, and balancing the resulting cardboard on a point; which point so found is the point sought.

Another way consists in cutting out the map, as before, along the boundary-line, and then suspending it behind a plumb-line, so that map and plumb-line hang from the same support: the projection of the plumb-line on the map is a line which passes through the centre of gravity of the area. By suspending the map successively from several differ-

ent points, a series of lines will be found, all of which theoretically pass through the centre of gravity of the figure.

Both of these methods have been tried on the map of the United States, and with the following result: —

A base map of the United States (scale about 112 miles to the inch) was cut out along the boundary, and the map so cut out suspended by a pin stuck through it. From the same pin a plumb-line was suspended. The map was swung upon the pin, and allowed to come to rest several times, and its mean position inferred. A line was then drawn on the map, representing the projection of the plumb-line upon the map in its mean position.

This process was repeated in several positions of the map, and a series of intersections determined, each intersection representing the centre of gravity, resulting from a pair of observations.

The centre sought was then assumed from an inspection of these points. From this adopted centre a circle with a radius of about one-sixteenth of an inch (some seven or eight miles in nature) would include all points except two resulting from very acute intersection, and which were rejected.

Again, a similar map was mounted on stiff cardboard, and then cut out along the boundary, as before. This was then balanced on the point of a spindle. It was balanced with the face of the map down, and then with the face up; and both balancings agreed in locating a point not differing visibly from the point determined by the preceding method.

This point, which according to one definition is the centre of the United States (Alaska excluded), is situated in latitude 39°.8 north, and longitude 98°.8 west of Greenwich. Platting this position on the land-office map, the point is found to be in *Cora township, Smith county, Kan.*, some ten miles south of the southern boundary of Nebraska, and a little to the westward of the middle of the state of Kansas.

These methods are directly applicable only to cases where the desired point is included in the given area. Such is the case with the United States, excluding Alaska.

If, now, we are to determine the centre, *including Alaska*, it will be necessary to determine the geographical centre of Alaska, and then determine, on the line joining these two centres regarded as a lever arm, the fulcrum between weights proportional to the areas of the United States alone, and of Alaska alone.

The centre of Alaska was found by the suspension method only. The intersections were all closely accordant, and locate the centre on the head waters of the Kuskokwim River in latitude 63°.4 north, and longitude 151°.5 west. The map used for the purpose was the base map of Alaska and adjacent regions, prepared some years ago by the coast survey.

These two centres found, as above described, were noted on a base map of North America, and joined by the projection of an arc of a great circle. This line was then divided into parts inversely proportional to the respective areas of the United States alone, and of Alaska alone; and the point so found is adopted as the centre sought. For this purpose the area of the United States was taken as 3,026,000, and of Alaska, 583,000 square miles. The centre is found to be in latitude 45°.0 north, and longitude 103°.5 west from Greenwich; which locates it near Slave Butte, Dakota, some twenty-five miles east from the boundary monument between Dakota, Montana, and Wyoming.

If we assume that the geographical centre is determined by the intersection of a parallel and meridian, which are the means of the extreme latitudes and longitudes, then we shall have for the United States, *excluding* Alaska, —

| | | |
|---|---|---|
| Northernmost latitude | (Minnesota) | 49° 24′ |
| Southernmost " | (Florida) | 24° 23′ |
| Mean latitude | | 36° 54′ |

| | | |
|---|---|---|
| Easternmost longitude | (Maine) | 66° 57′ |
| Westernmost " | (Washington Territory) | 124° 47′ |
| Mean longitude | | 95° 52′ |

and, *including* Alaska, —

| | | |
|---|---|---|
| Northernmost latitude | (Alaska) | 71° 22′ |
| Southernmost " | (Florida) | 24° 23′ |
| Mean latitude | | 47° 53′ |

| | | |
|---|---|---|
| Easternmost longitude | (Maine) | 66° 57′ |
| Westernmost " | (Alaska) | 187° 32′ |
| Mean longitude | | 127° 14′ |

In the first case (excluding Alaska) the centre lies in the Indian Territory, some seven miles from the southern boundary of Kansas, and about twenty-five miles a little west of south of Independence, Montgomery county, Kan.

In the second case (including Alaska) the centre is found to be in the Pacific Ocean, about one hundred and twenty-five miles a little south of west from Cape Flattery. This rather startling result brings into conspicuous notice the extension of the Alaskan possessions to the westward.

The only reference to the geographical centre of the United States that has met our notice is contained in the 'Fourth biennial report of the state board of agriculture to the legislature of the state of Kansas,' where it is stated, on p. 493, that "*Kansas is the central state of the Union, the exact geographical centre of the United States being at a point lying within a few miles of the centre of the state.*"

MARCUS BAKER.

Washington, D.C., April 15.

## Death of Dr. Albert Kellogg.

Among the recent deaths of scientific men, that of Dr. Albert Kellogg, the veteran botanist of the Pacific coast, is made known in the San Francisco papers.

He died in Alameda, Cal., on the 31st of March, at the age of seventy-four years. He was a native of New Hartford, Conn. For over thirty years Dr. Kellogg has been identified with the botany of California and the adjacent region, commencing Sept. 4, 1854, when he exhibited a drawing and specimen of a plant from the "salt marshes of the Bay of San Francisco, the Frankenia grandifolia," at a meeting of the California academy of sciences, of which he was one of the founders. During all these years he was constantly active, either in the field or the herbarium. He was exceedingly skilful with his pencil and brush in rendering from nature, and up to nearly the last moment was engaged in making drawings of the floral and sylvan species of the Pacific

states, particularly the sylva, with the intention of illustrating a work on the indigenous trees of California. He must have left a large and valuable series of figures, if not a completed monograph, of the botanical forms of the region referred to.

The published results of his various and prolonged investigations have appeared from time to time in the Proceedings and bulletins of the California academy and elsewhere; and his name holds a conspicuous place in all of the principal works relating to the botany of the western coast of North America.

In 1867 he visited the then Russian territory of Alaska in the capacity of surgeon and botanist to the special expedition of that year, having received the appointment from Prof. George Davidson, who had charge of the scientific division on that occasion.

Of his personal qualities, all who knew Dr. Kellogg will bear testimony to his simplicity, genuineness, and purity, and his invariable kindly disposition. His was altogether a rare and most lovable character. It may properly be said that his nature was in many ways as attractive as the beautiful forms he studied. Considering the period of his arrival in California, and the ruling passion and influences which governed the community at that time, as compared with his refined tastes and quiet ways of life, a most extraordinary contrast is presented. In the light of ordinary experience, it is hardly conceivable of a human being, among human beings of the same race, more absolutely out of place than he. However incongruous the surging tide and rush of affairs about him, he held the noiseless tenor of his way. His gentle life has passed. He will be affectionately remembered by many. R. E. J. S.

U. S. nat. mus., April 16.

## The barometer during thunder-storms.

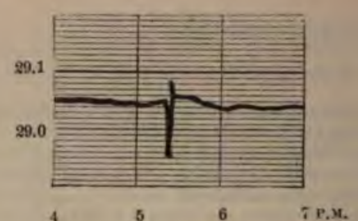
A sudden increased height of the barometric column lasting a short time, which almost invariably occurs with thunder-storms, has recently attracted considerable attention. German writers claim that notices of the phenomenon can be traced back to various observers in that country for more than one hundred years. Dr. Hellman finds a notice of it in the work of Herr J. J. Planer in the last century, and Dr. Ferrari finds a notice of it in the writings of Toaldo of Italy in 1794.

Mr. M. J. Johnson spoke of it in a paper read before the British association for the advancement of science in 1855. Since the somewhat general introduction of barographs, it has been so frequently and so widely noted, that I think it is now accepted as a characteristic phenomenon of thunder-storms.

Dr. Cirro Ferrari, however, claims that the little ridge of increased pressure attending the thunder-storm is only a part of the phenomenon. In front of this ridge he claims that there is a small trough or area of diminished pressure, and the most violent part of the thunder-storm falls between the two.

There are, however, a number of well-authenticated cases in which the barometer showed no indications of a diminished pressure preceding the passage of the storm, but showed an increased pressure during its passage. One of the most marked cases is given in the *American meteorological journal* (vol. i. p. 156), where it is shown that during the passage of a thunder-storm the barograph at Ann Arbor, Mich., rose .13 of an inch; but for ten hours preceding, and for twelve hours following, the storm, the recorded pressure did not vary perceptibly from 28.94 inches.

No marked thunder-storm has passed over Blue Hill since the starting of the barograph at the observatory, without giving indications of an increased pressure during the storm; but only a few have given indications of a diminished pressure preceding the storm, except the slow, steady fall of pressure in a general storm, or broad secondary, within which the thunder-storm occurred. There have, however, been a few marked cases of a decided diminution of pressure attending certain storms. So far as the records show, all of these storms were attended by very high winds. In a few of the cases the sharp depression of the barometer lasted fifteen or twenty minutes, and was followed by a rise lasting slightly longer. One of the most marked cases occurred on July 21, 1886, and the depression lasted only a few minutes. A copy of the barograph trace during this storm is given in the following diagram.




This thunder-storm, which was characterized by very vivid lightning, lasted from about 5 to 5.45 P.M. It was attended by a most violent squall, lasting from 5.12 to 5.17 P.M., during which a large dog-kennel was taken up and smashed to pieces, rain-gauges were overturned, and other damage done. During this squall the barograph pencil fell about .10 of an inch, giving the trace as seen on the diagram. Overlooking this sudden fall, it is seen that there was a gentle upward swell of the barograph curve, lasting thirty or forty minutes, during the passage of the thunder-storm.

I am led to infer that the sudden fall of pressure was due to the dynamic effect of the wind in sucking the air out of the building, while the rise in pressure was due to other causes. It has been found that a greatly increased wind-velocity usually precedes or accompanies the immediate beginning of a thunder-storm; and it is suggested that the diminished pressure which has been found by Dr. Ferrari in front of thunder-storms is due to the dynamic action of the wind on the barometer or its environment, something like the action of a Sprengel air-pump.

There yet remains, however, to be explained, the rise in pressure during thunder-storms. There are a number of reasons for believing this not due to a lower temperature or falling rain. Professor William Ferrel, in conversation, suggested that this also was a dynamic effect of the wind, and was due to a reactionary effect of the sudden expansion of the air ascending in thunder-storms, something like the recoil which takes place from the sudden expansion of ignited powder. There are undoubtedly very rapid moving currents of air in thunder-storms, and it may well be that their sudden expansion or collision produces the effect in question.

According to the view here presented, the following are some of the actions and reactions taking place in thunder-storms: —

1°. There exists above the earth's surface strong currents of air moving inward toward the central line or area of the thunder-storm. This is attested by balloon observations and by observations of clouds.

2°. There arises from the sudden expansion of air entering the vortex of thunder-storms from beneath a reaction which produces a compression of the air near the earth's surface, and a rise of the barometer.

3°. This compression causes the air near the earth's surface to tend outward in all directions from the centre of a thunder-storm; but the outflow in moving storms is only felt, or attains its greatest strength, on the front of the storm, where the direction of the outflow is combined with the progressive motion of the storm. In tornadoes the vortex usually reaches to the earth's surface, and there is no place for a vertical reaction; but where the vortex is some distance above the earth's surface, there is the same evidence of a straight outblowing wind moving in the direction of the tornado, as there is in a thunder-storm.

4°. This rapidly outflowing current, by its dynamic action on the barometer or its environment, frequently or generally causes a depression of the barometer in the front of thunder-storms, where the outflow is most violent. H. HELM CLAYTON.

Blue Hill meteor. observ., April 10.

## Snake and snake-like mounds in Minnesota.

From time immemorial a certain mythical or superstitious interest has attached itself to the serpent — the wisest of the beasts of the field — amongst most nations, whether civilized or barbarous, and his pictured or sculptured delineations have been the occasion for much writing on the part of antiquarians. In North America the creature has been depicted by the ancient inhabitants in various ways; as, for instance, by carvings on rocks, by outline arrangements of stones or bowlders placed on the ground, and, more sparingly, by mounds of earth. The latter belong to the class of earth-works known as 'effigies,' of which the 'Great Serpent' of Adams county, O., stands an unequalled representative. Indeed, with the exception of this one, no mounds representing snakes have hitherto been delineated and published, except one or two somewhat dubious specimens in Wisconsin.

In the course of my surveys in Minnesota, I have met with at least two such effigy-mounds, which, with some others looking suspiciously like tadpoles, I have drawn in plan for the engraver. They are numbered and described as follows: —

No. 1 is situated on the west side of St. Croix Lake, on the town-site of Afton, Washington county. The land here slopes toward the lake, and the Rattlesnake lies just above high-water mark. The head is 5½ feet high, 88 feet long, and 56 feet wide at the broadest point, which is also the highest, from which it gradually descends to the body. Where the head joins the body the embankment is 22 feet wide and nearly 2½ feet high. The body is but slightly curved. In the next 160 feet the width increases to 26 feet, but the height drops to 2 feet. From this point it gradually diminishes to 18 feet in width and 1 foot in height. Connected with the extremity or tail, there are three small mounds whose bases interlock, thus forming the rattles. The last of these mounds is 20 feet long and 18 feet wide, and the two between it and the tail are each 18 feet in diameter, and all three are of the same height as the end of the tail. The total length of this effigy is 534 feet. On June 25, 1883, when this survey was made, in addition to the snake, there were four round mounds and one embankment in the group. Formerly there were other mounds, but they had been demolished.

No. 2 is on the east side of Spring Creek, some three miles westward from Red Wing. It has a perceptible head, which is 8 feet wide and 1 foot high; the neck is nearly 7 feet wide and 10 inches in height. From the latter point the body gradually increases its width until the middle is reached, where it is 14 feet wide and 2 feet high: thence it decreases to the

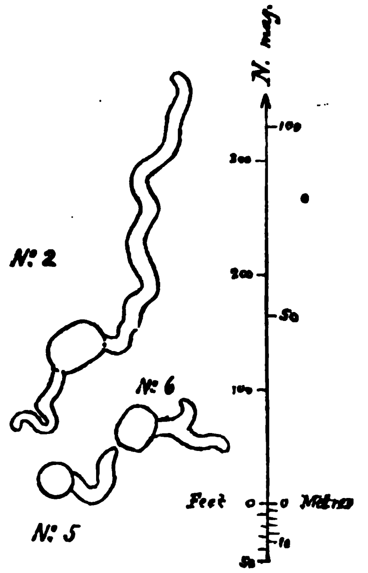

end of the tail, which is 8 feet wide and 1 foot high. Its total length following the curves is 430 feet. The mound which covers the body near the head is 52 feet in length, 36 feet wide, and 5 feet in height. From general appearances it would seem that it was built after the snake was constructed; for the slope of the mound where it strikes the body of the snake is somewhat irregular, and indicates that its builders were at a loss to know how to join them symmetrically. These irregularities are not caused by the dirt washing down from the top of the mound, for otherwise it is perfectly symmetrical and the base well defined.

No. 3 is in another group of mounds about 250 yards down the same creek from the preceding one. The head is circular in form, being 40 feet in diameter and 3½ feet high. The body at the junction with

the head is 20 feet wide and 1½ feet high, but gradually decreases to a point 97 feet distant, where it is but 14 feet wide and 1 foot high. Thence to the end of the tail it retains the latter width and height. Its total length, following the curves, is 290 feet.

No. 4 is in the same group, and lies south-west of the tail of No. 3, 35 feet. The head is circular, being 36 feet in diameter and 4 feet high. The body at the junction with the head is 16 feet wide and 1½ feet high. From this point it gradually decreases in width to the end of the tail, which is 12 feet wide and 1 foot high. The extreme length of this effigy is 300 feet. The heads of Nos. 3 and 4 are away from the creek. In addition to Nos. 3 and 4, there are nine small round mounds in the group.

No. 5 is in the same group with No. 2, and its head is 40 feet south-east from the head of the latter, and rests on the edge of the plateau. The head is

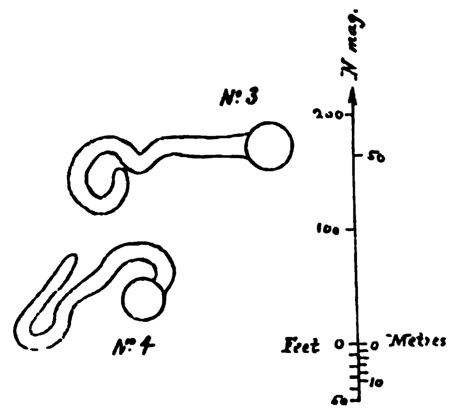



30 feet in diameter and 4 feet high. The body at the junction with the head is 20 feet wide and 1 foot high, and does not vary until within 20 feet of the end of the tail. From this width it gradually diminishes to 6 feet. Its total length, following the curves, is 105 feet.

No. 6 is close to No. 5, its head being only 10 feet from the end of the tail of the latter. The head differs from the others in being oblong, and is 40 feet long, 30 feet wide, and 3 feet high. About one-third of the way from the head the body forks, forming two tails of unequal length. Near the head the body is 16 feet wide and 1½ feet high, and at the end of each of the tails 8 feet wide and 1 foot high. Its greatest length, from the extremity of the head to the tip of the longest tail, is 105 feet.

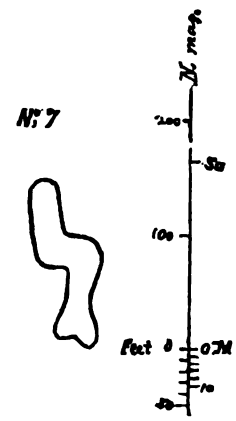
The heads of Nos. 2, 5, and 6 are towards the creek, and, in addition to them, there are sixteen mounds and embankments. Both of these Spring Creek groups are on a plateau some 40 feet above the water, and were covered with brush and young timber when the survey was made (Sept. 5, 1885), but Nos. 3 and 4 are now cultivated.

No. 7 is near the south end of Lake Koronis, west of the outlet, in Meeker county. Although this mound is serpentine in form, and apparently has an open mouth, it is hard to determine exactly what it is intended to represent. The head at its widest point is 36 feet broad and 2½ feet high. The body varies from 20 feet in width at its junction with the head, to 34 feet near the middle and 25 feet near the end of the tail, and is 2 feet high. Its greatest




length, following the curve, is 167 feet. In addition to this stumpy snake, there are thirty-two other mounds and embankments in the group. Directly opposite, on the east side of the outlet, there is another small group of mounds, the largest of which is nearly circular in form, and is 19 feet high. These groups were surveyed Nov. 8, 1886.

The reader fond of comparison can, if he pleases contrast these Minnesota serpents with the Great Serpent of Ohio, by making use of the following di-




mensions of the latter, as measured Feb. 18, 1886: total length from tips of jaws (if closed), following the windings of the body, to the end of the convoluted tail, is 1,020 feet; length of head, about 120 feet; width of head, 80 feet. The body and tail vary in width from about 30 feet at the neck, to 8 feet at the tip of the tail, and in present height from 3½ feet to 1 foot.

T. H. LEWIS.

St. Paul, Minn., April 6.

## Calendar of Societies.

*Philosophical society, Washington.*

*April* 13. — G. W. Hill, On the motion of Hyperion; Asaph Hall, On the parallax of $\alpha$ Tauri.

*Biological society, Washington.*

*April* 16. — W. H. Dall, Notes on a recent exploring trip in Florida; H. G. Beyer, On the action of caffeine upon the kidneys; C. H. Merriam, Ravages of the bobolink in the rice-fields of the south; F. A. Lucas, On the os prominens in birds.

*Engineers' club, Philadelphia.*

*April* 2. — Theo. Low, Notes on railroad construction; F. W. Whiting, Prevention of the spreading of fires; Francis Lightfoot, Description of a stamp splice, tongue, and groove rail joint; Max Livingston, Petroleum.

*Natural science association, Staten Island.*

*April* 9. — N. L. Britton, The study of fungi.

*Connecticut academy of arts and sciences.*

*April* 20. — Professor Brewer, Sequoia; The man and the tree; Professor Chittenden, Absorption and distribution of poisons in acute and chronic cases.

*Boston society of natural history.*

*April* 20. — J. Amory Jeffries, Reply to Dr. Gardiner's paper on the homologies and development of hoofs, nails, and claws; Edwin O. Jordan, 'Vitality' of minerals, plants, and animals, from a geological point of view.

*Boston scientific society.*

*April* 12. — S. Kneeland, Cremation, and other methods of disposing of the dead; A. Storer, Projections of Lissajou's curves.

*Natural history society. Agricultural college, Michigan.*

*April* 8. — C. P. Gillette, Plant-lice; C. B. Cook, A winter at Ward's museum; P. G. Holden, Throwing of seeds by the wych-hazel; G. C. Teller, Starch from domestic and wild potato; W. J. Meyers, The manufacture of buttons from vegetable ivory, Harry Thurtell, Comparative anatomy of cat and rabbit.

## Publications received at Editor's Office, April 11–16.

ADAM, J., *ed.* Platonis apologia Socratis. Part i. Cambridge, Eng., University pr. 136 p. 16°. (New York, Macmillan, 90 cents.)

BOND, J., and WALPOLE, A. S. Gai Iuli Caesaris de bello Gallico commentarii. New York, Macmillan. 419 p. 16° $1 60.

CHALLENGER, report of the scientific results of the exploring voyage of the. Zoölogy, vol. xviii. Parts i. and ii. London, Government. Pl. 4°.

COLBECK, C. Gai Iuli Caesaris de bello Gallico, commentariorum v. New York, Macmillan. 128 p. 24°. 40 cents.

CORFIELD, W. H. The treatment and utilisation of sewage. 3d ed. New York, Macmillan. 511 p. 8°. $4.50.

FLORIDA state geological survey, 1887. Tallahassee, State. 31 p. 8°.

GODLEY, A. D. The histories of Tacitus, books i. and ii. New York, Macmillan. 262 p. 16°. $1.10.

HOLDEN, H. A. The Cyropaedeia of Xenophon, books i. and ii. Parts i. and ii. Cambridge, Eng., University pr. 83+355 p. 16°. (New York, Macmillan, $1.50.)

HUXLEY, L. Cicero Cato maior de senectute. Part i. Oxford, Clarendon pr. 64 p. 16°. (New York, Macmillan, 50 cents.)

LESSING und GELLERT. Fabeln und Erzählungen. Ed. by K. Breul. Cambridge, Eng., University pr. 200 p. 16°. (New York, Macmillan, 75 cents.)

LUMBY, J. R. Cowley's prose works. Cambridge, Eng., University pr. 248 p. 16°. (New York, Macmillan, $1.)

MILLER, L. W. The essentials of perspective. New York, Scribner. 107 p. 12°. $1.50.

NEW JERSEY. Annual report of the state geologist, for the year 1886. Trenton, State. 254 p. 8°.

PESKETT, A. G., *ed.* M. Tulli Ciceronis oratio philippica secunda. Part i. Cambridge, Eng., University pr. 151 p. 16°. (New York, Macmillan, 90 cents.)

SCRIBE, E., et LEGOUVÉ, E. Bataille de dames ou un duel en amour comédie. Ed. by H. A. Bull. Cambridge, Eng., University pr. 96 p. 16°. (New York, Macmillan, 50 cents.)

SIMMONS, C., *ed.* The metamorphoses of Ovid, books xiii. and xiv. New York, Macmillan. 256 p. 16°. $1.10.

STEWART, A. Our temperaments: their study and their teaching. London, Crosby Lockwood & Co. 394 p. 8°.

VIGNY, A. de. La canne de jonc. Ed. by H. A. Bull. Cambridge, Eng., University pr. 95 p. 16°. (New York, Macmillan, 50 cents.)

## Advertised Books of Reference.

THE STANDARD NATURAL HISTORY. By all the leading American scientists. Edited by J. S. Kingsley, Ph.D. Vol. I. Lower Invertebrates. Vol. II. Crustacea and Insects. Vol. III. Fishes and Reptiles. Vol. IV. Birds. Vol. V. Mammals, Vol. VI. Man. 6 vols., nearly 2,500 illustrations and 3,000 pages. Imp. 8vo, cloth, $36 00; half morocco, $48.00. S. E. Cassino & Co. (Bradlee Whidden), Publishers, Boston.

SCIENCE ECONOMIC DISCUSSION. A controversy between the adherents of the old and new schools of political economy regarding their main points of difference, by Henry C. Adams, Richard T. Ely, Arthur T. Hadley, E. J. James, Simon Newcomb, Simon N. Patten, Edwin R. A. Seligman, Richmond M. Smith, and Frank W. Taussig. 12mo. Paper, 50 cts. Science Company, Pubs., New York.

JOURNAL OF THE ELISHA MITCHELL SCIENTIFIC SOCIETY. To defray expense of publication this journal is offered at nearly cost. 3 vols. 350 pp. for $1.25. These contain biographies and portraits (two of them steel engravings) of Dr. Mitchell, Dr. Curtis and Dr. von Schweinitz, a complete flora and map of the Wilmington Section besides many botanical, chemical, biological, geological and meteorological articles. About 75 copies for sale. Address: F. P. Venable, Sec'y, Chapel Hill, N. C.

MAMMALS OF THE ADIRONDACKS. By Dr. C. Hart Merriam. Contains an introductory chapter treating of the location and boundaries of the region, its geographical history, topography, climate, general features, botany, and faunal position. This work consists, in the first place, of a general account of the prominent features of the Adirondack region; and, secondly of a popular narrative of the habits of the animals found within its confines. Imp. 8vo. $3.50. Henry Holt & Co., New York.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 22, 1887.

## CO-OPERATION ON THE CONTINENT OF EUROPE.

### I. — FRANCE.

ABOUT a year ago the British minister for foreign affairs addressed a circular to her Majesty's representatives at Paris, Berlin, Vienna, Rome, Brussels, The Hague, and Stockholm, indicating certain information as to co-operation in those countries which the government desired to obtain. The official replies to the circular contain a great mass of information as to co-operation, much of it difficult to be obtained by any one save a government official. Much of the value of the reports is concealed because of their not having been edited or compiled in any way. Each investigator obtained such facts as he could, and stated them in the way most convenient to himself. We shall call attention to such facts in the reports as are of value in connection with the general attention now being given to co-operation in this country.

The principal questions to which replies were desired were these : —

1. To what extent have industrial co-operative stores been established among the working-classes, and upon what basis?

2. (a) How far have co-operative workshops been established either by associations of workmen or by arrangements between employers and employed?
   (b) Have they been successful commercially, and how far do they prevent strikes and other disputes?
   (c) Upon what terms are profits usually divided in such workshops?

3. Are there any successful co-operative or people's banks, and what is their mode of operation?

4. Are there any instances of co-operative societies which provide social, educational, and recreative facilities for the working-people on a self-supporting basis?

5. Are there any co-operative societies for providing improved dwellings for artisans and laboring people? What system do they adopt, and with what success?

6. Is agriculture carried on by means of co-operation with any success?

7. Give details of any co-operative arrangements for carrying on shipping, fishing, and industries other than those already mentioned.

From France comes the answer that save at Lyons, the system of co-operation for diminishing the cost of articles of daily use is rarely met with. Owing to the nomad habits of the working population of Paris, it is particularly neglected in that city. At Mulhausen in 1832 the first instance of a French effort in this direction is found, in the establishment of a co-operative bread-store which managed to realize a profit, while supplying its members with bread at a reduction from the ordinary retail price. In 1849 this association numbered fifteen hundred members. The early attempts at co-operation were made at the instance of the employers, and not at that of the workmen. Lyons has been the seat of numerous co-operative enterprises, most of which were started by workmen. The co-operative stores in France are either for bread or meat alone, or for groceries, combined sometimes with clothes, drapery, and objects of household use. The bread-stores have the most success. The Angoulême store sold in 1874 — eight years after its foundation — five hundred thousand kilos of bread at about five centimes a kilo below the price asked by private bakers.

The last general statistics of co-operative supply associations are those of 1869, when there were in France and Algeria together about a hundred and twenty co-operative bakeries. Since then many others have been formed, but though increasing, co-operative supply has taken no great hold in France.

Co-operative workshops, however, have been in existence since J. Buchez began an agitation in their favor, as long ago as 1830. The main result of Buchez's teaching was a jewellers' association. The system of this co-operative society was to put by a seventh of the profits for the inalienable capital or foundation fund, and to divide the remainder amongst the members : one half of this remainder was paid over at once ; the other half, left in the business till the member's death or retirement, when it was to be returned. The working-members were paid weekly an amount corresponding to the usual wages paid for the work they may have done, and the rules of the association laid down that there should be six working-days a week, of eleven hours each, and that whoever stopped work for three days without the per-

mission of one of the two managers (who were chosen by election) should be fined, and if the offence were repeated during the year, the fine was doubled.

Before the revolution of 1848 the French government was very jealous of innovations not emanating from itself or submitted for its approval; but after 1848 the right of workmen to associate so as to enjoy the profits of their work was recognized, and co-operation became popular. On July 5, 1848, the chamber passed a decree which provided, that, in order to encourage the spirit of co-operation, a fund of three million francs should be placed at the disposal of the minister of agriculture and commerce, to be divided among co-operative associations spontaneously formed either between workmen, or masters and workmen. Shortly afterwards a committee of sixteen met to distribute this state aid. Five hundred requests for loans from this fund were received in a single year, and many associations came into existence solely for the purpose of obtaining a share of the subsidy. As a matter of fact, the major part of the loan was given to employers in want of temporary assistance, who failed to comply with the provisions of the statutes as to their relations with their workmen. The results of this government aid are said to have been good, and some saving was effected by employing these associations instead of contractors on publics works.

The *coup d'état* of 1851 gave a shock to co-operation in France, and the associations dissolved, fearing punishment as socialists.

Whilst the movement was thus generally arrested by the workmen's dread of the government, a few new co-operative associations were quietly started. The first of which there is any notice was one of dyers, at Villefranche, in 1856; in 1858 there were formed co-operations of tailors at Toulouse, of carpenters in Paris, and of dyers at Tarare; in 1859, of house-painters in Paris; and in 1860 and 1862 co-operative workshops were started at Marseilles and Montpellier.

In 1864 the emperor showed that he had no opposition to co-operation by protecting the first branch of the famous Société internationale. In 1865 he went a step further, and caused to be drawn a *projet de loi* creating a new form of association for workmen's co-operative societies. This effort was not wholly successful, and an inquiry into the whole working of co-operation was instituted. The evidence was of much interest, and tended to establish the fact that the labor of an associated workman is better than that of the unassociated. In 1868, when co-operation was growing in favor, the failure of the Crédit au travail — a society established to give credit to co-operation by discounting the paper of the associations, and by opening a credit with them on suitable security — put a sudden stop to all co-operative progress. The Crédit au travail failed, not because of losses, but because the capital of the bank was locked up and unavailable. Neither the Franco-German war nor the Commune seem to have affected the co-operative societies. The period between 1870 and 1880 was largely devoted to talk and the elaboration of impracticable schemes, and it was not until the strikes of 1879 and 1880 that general attention was again turned to co-operation. A congress of workmen, meeting at Paris in 1881, advocated co-operation through the trades syndicates, and a number of societies were formed in this way. In 1883 M. Waldeck-Rousseau, minister of the interior, appointed a commission to investigate co-operation, and the results of the inquiry fill two large volumes. The evidence given before the commission by the managers of thirty-four Paris co-operative workshops was very detailed and in many respects valuable. The three principal names in connection with co-operative production in France are those of M. Leclaire, the painter; M. Laroche Joubert, the Angoulême paper-manufacturer; and M. Godin, the founder of the Familistère. What the associations organized by these men have accomplished is well known.

The details regarding co-operative credit institutions in France present little that is new, and building associations are very rarely found. Indeed, no instance of workmen alone combining for this object is known. One reference to education in the statutes of a co-operative association of tin-workers is worth noticing. It reads thus: "As immorality proceeds from want of instruction, every member who has children is bound to give them instruction according to his means, under pain of exclusion from the society after two warnings given at intervals of three months."

Co-operative agricultural associations do not exist in France, and have proved a failure in Algeria. On the Mediterranean as on the Newfoundland coasts, it is usual for the fishermen to share the profits with the owners and masters of their crafts. The usual plan of division in the neighborhood of Marseilles is that half the take belongs to the owner of the boat and gear, the other half to the captain and crew *pro rata*. The system of giving the hands regular wages instead of a share in the profits is now on the increase.

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DR. EMERY of Brooklyn reports the poisoning of thirty-two boys at an orphan-asylum in that city from chewing the inner bark of the locust-tree, which they stripped from fence-posts.

## SANITARY EXAMINATIONS OF WATER, AIR, AND FOOD.

THE first edition of this book, which appeared in 1878, supplied a want, which had long been felt by health-officers, for a book which would help them to solve the problems which presented themselves for solution almost daily in their efforts to provide, for those committed to their care, pure water, air, and food. Dr. Fox's brochure on water-analysis was recognized as a work of great value, and two editions of it had been exhausted. When a third edition was called for, its scope was extended by adding sections on the examination of air and food. In the section devoted to the sanitary examination of drinking-water, we find all the well-known tests for the determination of organic matter, and, in addition, the biological method of Koch, which, in Germany at least, is regarded as being as important as the chemical analysis. Chemistry gives no indication of the presence or the number of micro-organisms; and there is no doubt that water has been declared suitable for drinking-purposes, as a result of chemical analysis, when, had the biological method been known and employed, a far different opinion as to its potability would have been given.

The determination of the nature and life-history of the microbes found in water is too difficult for the health-officer, unless he be at the same time a bacteriologist, and so situated as to be able to investigate them in a properly equipped laboratory; but the ability to ascertain whether their number in a given water is beyond the normal amount is certainly within his reach. The methods to be employed in such an examination are fully described, and the apparatus abundantly illustrated, in the work before us. In a table given by the author, showing of what this method is capable, it is observed that the number of micro-organisms in the different metropolitan waters varies markedly at different seasons, and in the waters as compared with each other. In the water of the Thames at Chelsea, in January, there were 8 in one cubic centimetre; in February, 23; in June, 81; in September, 13; and in November, 3. In the water of the River Lea there were 25 in January, 121 in May, and 317 in December. The water of the Kent company leaves the well almost wholly destitute of organic life, and the few organisms which it contains are imported into it *en route* to its supply.

In the chapter descriptive of the microscopic examination of water there is much that is valuable. By the aid of the microscope, an approximate estimate may be made of the number of micro-organisms and the diagnosis of the kind,—whether bacteria, bacilli, micrococci, vibrios, spirilla, etc. The kind of animal and vegetable life seen in water gives a certain clew to the description of the water under examination. The Infusoriae, Confervae, and Vorticellae are the inhabitants of the least pure of spring-waters; then come the diatoms and desmids; Entomostraca, or water-fleas, are seen in spring-ponds, lochs, and impounded waters; euplota and fungoid growths abound in ditch and pond waters, and in well-water polluted with filth; whilst bacteria, paramecia, and spirilla are prominent in sewage-polluted water. Dr. Frankland regards the presence of any thing like a moving organism in a water as a danger-signal, for the reason that, if the poisons of such diseases as cholera and typhoid-fever attach themselves to particles of organic matter, and can operate in inconceivably minute quantities, as is generally believed, there is a possibility of the disease-ferment or germ of such maladies accompanying elementary forms of life. Two plates are given of microscopic objects found in drinking-water.

In the section which takes up the sanitary examination of air, the author describes the various impurities found in air which render it unfit for respiration, including sewage emanations, poisonous gases and injurious vapors, emanations from ground having damp and filthy subsoil, and from churchyards, and the deleterious effects on health of impure air in our houses. The methods for the detection and estimation of the amount of the most important impurities found in the air are fully dealt with, including both the microscopical and biological methods. Chapters are also devoted to ozone, temperature, solar radiation, barometric pressure of the air, direction of the wind, etc., and their relations to health.

One of the most interesting chapters in the book is that which treats of the meteorological conditions which appear to favor or retard the development of certain diseases. Of these, twenty-one are mentioned, — surgical fever and shock after operations, small-pox, measles, whooping-cough, scarlet-fever, typhus, typhoid, intermittent fever, diarrhoea, dysentery, cholera, bronchitis, pneumonia, asthma, phthisis, diphtheria, hydrophobia, erysipelas, puerperal fever, insanity, and rheumatism. Small-pox has been found, in London and in Sweden, to prevail more from November to May than from May to November. Measles is most prevalent towards the end of March: it gradually declines, and by midsummer disappears. Diarrhoea is a summer-autumn complaint, and typhoid a late-autumn fever. The latter is more prevalent after dry and hot summers than after those which

*Sanitary examinations of water, air, and food.* By CORNELIUS B. FOX. 2d ed. Philadelphia, Blakiston. 12°.

are cool and wet. Bronchitis, pneumonia, and asthma increase as the temperature falls, and diminish as it rises. The damp, cold days of November, and the dry, cold days of the early months of the year, have been most prolific in cases of diphtheria. As to hydrophobia, the hot 'dog-days' of summer are generally considered to be those during which this disease is most prevalent; and this ancient belief is justified to some extent by facts, although we must remember that it shows itself to be independent, in its spread, of a high temperature, as the mortality in London during thirty years proves. The number of cases is as numerous in December as in August. More persons, doubtless, are bitten by dogs in hot weather, because dogs are more irritable during this season. We want an answer to the query as to the percentage of cases of hydrophobia in those who are bitten in each month of the year, before we can determine with certainty the influence of meteorological conditions on the disease. In this section are also given directions for observing the meteorological states and variations in the conditions of the air, as to its pressure, temperature, and moisture, the direction and strength of the wind, and its electrical state.

The last section of the book is taken up with a consideration of the food, its impurities, and methods of inspection and examination, including the inspection of meat, poultry, game, fish, fruit, and vegetables. Separate chapters are devoted to tinned provisions, corn, flour, bread, and milk. On the subject of tinned provisions, or 'canned goods,' as we should call them, Dr. Fox says that preserved Australian meats, and American tinned fish, fruit, etc., are apt to become impregnated with small quantities of lead from the solder and tin, which frequently contain, as impurities, arsenic and antimony. The vegetable and other acids associated with these provisions have a corrosive effect, which is increased by the galvanic action set up between the metals. In the chapters on milk and its examination the author gives numerous instances of disease caused by impure milk or by that from sick cows. The evidence that tuberculosis may be thus communicated is very striking and very convincing, if, indeed, there be any at the present day who, having given the subject any consideration, doubt it. Taken as a whole, this work of Dr. Fox is an excellent one, and should be in the library of every sanitarian and physician.

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A PHYSICIAN of Caracas reports, that, during an epidemic of yellow-fever which occurred in that place, one of the victims was a monkey. After an illness of four days, the fever proved fatal.

## *SCIENTIFIC WRITINGS OF JOSEPH HENRY.*

AT last, although somewhat tardily, as it has seemed to many, the regents of the Smithsonian institution, by the publication of these volumes, have enabled the general public to form a correct estimate of the great services of its first secretary, and have justified the opinion, long held by many of his countrymen, that Joseph Henry was unquestionably the first American physicist of his time. The Smithsonian institution, with the national museum, has been generally recognized as a monument to his wisdom, foresight, and patriotic self-sacrifice. How great this sacrifice was, demanding, as it did, almost total neglect of original research, — which he so loved, and for which he was so well fitted, — will be clearly understood on a perusal of these volumes.

The published papers of Henry, especially the earlier, and in many respects the most valuable, have long been well-nigh inaccessible. In later years he was too busy to follow the example of other eminent philosophers in collecting, editing, and republishing the work of his early years. Although an avenue for such reproduction of his numerous contributions to science was always open to him in the publication department of the Smithsonian institution, he never consented to utilize the facilities which he had so thoughtfully perfected for his fellow-workers, and which have proved such a boon to science and to scientific men.

The two handsome volumes now issued, naturally include a wide variety of subjects. The collection of papers is divided into two parts: a chronological arrangement is, in general, followed. But in order to equalize the size of the two volumes, the elaborate studies of and reports upon various phenomena connected with the transmission of sound, made between 1873 and 1877, while Henry was a member of the lighthouse board, are inserted out of their regular order, in the first volume.

Part i. includes papers published while a professor at Albany and afterwards at Princeton. This record covers a period of twenty-three years, from 1824 to 1846. It is contained in the first 260 pages of the first volume. Part ii. contains his scientific work during the remaining thirty-two years of his life, while director of the Smithsonian institution, from 1847 to 1878. Physicists will generally be most interested in part i., which contains nearly all of his original researches in electricity.

Born only five years later than Faraday, much

*Scientific writings of Joseph Henry.* 2 vols. Washington, Smithsonian institution. 8°.

of Henry's work ran parallel with that of the most distinguished experimental physicist of this or, indeed, any age. In several instances they attacked the same problem almost simultaneously, and often independently of each other. The great discovery by Faraday, on Sept. 24, 1831, of electro-magnetic induction, inaugurated an era of greatly increased activity in electrical research. Henry had thought much concerning the relation of magnetism to electricity, and had devoted the early part of the same year to his very important research looking to the improvement of the electro-magnet, with the intention of making use of it in an attack upon the then unsolved problem. The pressure of other duties prevented him from taking up the work until after the commencement of Faraday's success, but his improvement of the magnet was of sufficient importance to stand alone as a most valuable contribution, since through it Morse's system of telegraphy was made possible.

He at once repeated Faraday's experiments, and extended them, with interesting results. The difficulties under which he labored, arising out of his occupation, and also from the difference, far greater then than now, between London and Albany or Princeton as centres of intellectual activity, were more considerable than those which his distinguished contemporary was obliged to overcome. Those were the days in which quantitative measurements in electricity were made by comparison of sparks produced on file and rasp, by observing rapidity of decomposition, by the magnetization of sewing-needles, or in which men *felt* their way to results through shocks in the arms, fingers, or tongue. In those days batteries were inconstant and short-lived, connections were made with mercury cups, conductors were carefully insulated by a silk covering put on by the experimenter himself, and 'bell-wire' was almost the only available material for circuits. Henry independently produced the spark from the magnet, but afterwards learned that he had been anticipated in the observation in England. In 1832 he discovered self-induction in a long wire, and correctly, though somewhat hesitatingly, interpreted the phenomenon. This was not observed by Faraday until 1834, and at first he did not comprehend the true nature of the operation. He corrected his error in 1835, and the credit of the discovery has been generally accorded to him. At an early date, Henry produced current-induction by means of 'common' electricity, which Faraday had not at first been able to accomplish.

In one of his numerous variations of Faraday's experiment, in which he used flat coils or spirals, he tried the effect of interposing a conducting-plate between the primary and secondary coils. He found that the shock from the secondary coil was almost totally destroyed by the introduction of a plate of copper or other conducting-material between it and the primary.

This was an important conclusion, and led to important results. Shortly after its publication, he received from Faraday a copy of his fourteenth series of experimental researches, in which he makes a statement diametrically opposed to that of Henry in reference to this effect, being, in substance, that the interposition of a conducting-plate made not the slightest difference in the result. This naturally excited in Henry a lively interest in the question, and he made an extensive investigation in order to determine which view was erroneous.

Curiously enough, both were correct. Faraday used a galvanometer in his experiments: Henry observed the strength of shocks, or the physiological effect. There are undoubtedly induced currents in the interposed conductors; but they will be transient, and their integral effect on the number of lines of force passing through the secondary will be zero. The effect, then, will be that the time of the rise and fall of the induced current will be altered. The variation taking place within a small fraction of the period of the galvanometer needle, the throw of the needle will not be changed; but the effect of the shock will be greatly modified, and may become insensible. Henry did not leave this question until he thoroughly understood the cause of the discrepancy.

The most important result of his original experiment, however, was that it led him to the discovery of induced currents of the second, third, and fourth orders.

It is not possible to refer, in this place, to many other investigations of great interest which are to be found recorded in part i. A few of them relate to other departments of physical science, and some of them are not well known, even to his own countrymen. On the very first page will be found an account of a most admirable lecture experiment, which might well find a place in our modern courses, but which is probably not generally known to professors of physics.

Many lovers of pure science will find it hard, after a perusal of part i., to avoid a feeling of regret that Henry was not allowed to continue his researches, instead of being called to the directorship of the Smithsonian institution. That he was exceptionally well qualified for this important post, no one will deny, although it must have been accepted at a sacrifice which no one understood better than Henry himself. Throughout his long connection with the institution, and during a career which needs no praise and requires no comment, he con-

tinued his scientific work whenever opportunity was offered. But this work was largely of a character different from that of his earlier years. Many of his papers in the first part show that his nature was too large to permit of his assuming, as some men of science have assumed, and even boastfully, an absolute indifference as to the so-called practical applications of his investigations, and their worth as a means of bettering the condition of mankind. His work while director of the Smithsonian was very closely related to applied science. He was now called upon to consider and decide questions of great practical importance. Much of his time, which he would doubtless have gladly given to researches of a higher order, was occupied in devising methods of testing materials for public buildings, in considering the acoustics of public halls, in investigating the relative value of illuminants for the lighthouse board ; and in the capacity of chairman of this board he planned and executed the extensive and important series of experiments and investigations on the use of fog-horns, steam-whistles, etc., and on the transmission of sound, which are printed at length in the latter part of the first volume. A large part of the second volume is devoted to an extended series of essays on meteorology. This was a subject in which Henry had always been interested. On the organization of the Smithsonian institute, he had named meteorology as one of the subjects the investigation of which could properly be assumed by the new establishment. As early as 1848 he suggested the use of the telegraph in the study of American storms, and explained the benefit which would accrue to commerce and agriculture from its use in the dissemination of weather-warnings. He organized a gigantic system of voluntary meteorological observers, by the aid of which much light was thrown upon the climatic conditions of the country. All of the meteorological work of the institute was finally turned over to the U. S. signal service upon its organization, and the success of this service was and is largely due to Henry's labors as a pioneer.

His essays on meteorology were in plain and unpretentious language ; the medium of their publication was such as to secure their wide distribution and diffusion among the masses of the people; and the general interest in the subject to-day, as well as the general intelligence of the public in regard to it, must be largely attributed to their influence. These essays constituted the first easily accessible scientific treatment of the physics of atmospheric phenomena which appeared in this country, and they contain much matter of great value to the meteorologist of the present time.

The reader will thank the editors for including in this collection several essays and addresses to scientific societies concerning their organization and working-plans, which, although not strictly scientific, have had, and will continue to have, an important bearing upon the progress of science. In every respect the work of compilation seems to have been done with exactness and care ; most readers, however, would have welcomed the addition of a good portrait and a brief biography.

The publication and circulation of these volumes will enable scientific men, both at home and abroad, to make a juster estimate of Henry's great services to science, and the study of his earlier researches must convince competent judges that he was one of the really strong physicists of the first half of the present century.

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## *STORER'S AGRICULTURE.*

UNDER the modest title of 'Agriculture in some of its relations with chemistry,' Professor Storer has given us what, in our judgment, is the most noteworthy contribution to agricultural literature of recent years, either in this or any other country. We say this advisedly, and after a careful examination of the book.

It may be said to treat broadly of manures and fertilizers, or better, perhaps, of 'plant-feeding,' since it includes, along with the main topic of manures and manurial substances and their application, much with regard to the plant itself ; the soil and atmosphere, which are the media of its growth, and from which its food is derived ; the culture and handling of different crops ; and the adaptation of crops and systems of farming to local conditions.

The subject is a difficult one to treat satisfactorily, on account of its complexity and also because of the very imperfect state of our knowledge upon it in many directions, and accordingly there has been a dearth of good books upon it. As regards the English language, the dearth may be said to have been absolute. There has been hitherto no book treating of these matters which could be recommended to a student who desired any thing remotely approaching a thorough and systematic acquaintance with the present state of our knowledge on this subject.

The students of other countries have been somewhat better off ; but even there, so far as the writer's acquaintance with the literature of agriculture extends, there has been no one work which adequately covered the whole field of plant-feeding in its scientific and practical aspects. This

*Agriculture in some of its relations with chemistry.* By F. H. STORER. New York, Scribner. 8°.

we think Professor Storer's book does. While, in the words of the preface, 'it makes no special appeal to chemists or students of chemistry,' it is nevertheless a thoroughly scientific book in the truest sense of the term. While it is strikingly free from the technicalities of science, its statements and discussions are based on so thorough a knowledge of science in its relations to agriculture, and so pervaded by the scientific spirit, as to render the book most valuable to all students of agricultural science.

It is, however, in its felicitous union of science with practice that the book is pre-eminent. Many otherwise good agricultural books suffer from a certain impracticability, arising from a deficient acquaintance, on the part of their writers, with the conditions of practice; while of others exactly the converse is true. Neither of these faults, however, can be attributed to the present work. While its scientific merits commend it to the student of science, its practical common sense as well as the lucidity and suggestiveness of its discussions will commend it no less to the thinking farmer. Indeed, we anticipate that one of the most valuable features of the book will prove to be that it will, on the one hand, help to remove the prejudice against science which is still too prevalent among farmers, and, on the other hand, tend to inspire in the minds of students of science a greater respect for, and a more earnest study of, the practices and maxims of successful practical agriculture.

## GEOLOGY OF MINNESOTA.

THE annual reports of state surveys are, for the most part, dull reading, especially for non-residents; since they are necessarily of a detailed and fragmentary character, showing the progress of investigation in many different directions, with very little completed work. Both the reports before us, however, embody material of more than local interest, and it is desired to call attention here to those portions, without attempting to notice the entire contents of the volumes.

The notes on the section from Duluth north to the iron-mines about Vermilion Lake give Professor Winchell's latest views concerning the stratigraphy of the crystalline rocks of north-eastern Minnesota, between Lake Superior and the international boundary. The height of land between Lakes Superior and Vermilion is marked by two distinct ranges, — the high and broad Mesabi Range, composed of eruptive gabbro and red metamorphic granite; and, north of this, the lower and narrower Giant's Range, consisting of gray and red syenites, which have been referred to the Laurentian, and mark an important anticlinal axis. North of this axis, and dipping north at high angles, is a broad belt of the green and red jaspery and magnesian schists and conglomerates referred to the Huronian. South of the axis, the Huronian series appears to be concealed by a fault; but we have above it, dipping to the south in conformable succession, the Animikie slates and quartzites, the gabbro and granite of the Mesabi Range, and the greenish trap of the cupriferous series, extending from the Mesabi Range to Lake Superior.

*Thirteenth and fourteenth annual reports of the geological and natural history survey of Minnesota, for the years* 1884 *and* 1885. By N. H. WINCHELL. St. Paul, State. 8°.

The gabbro, Animikie, and Huronian series are each characterized by important deposits of iron ore; and this district is, with almost phenomenal rapidity, assuming a position of the first importance as regards the products of its mines. The iron of the gabbro belt is, as usually with rocks of that class, titanic. It furnishes the iron-sand of the Lake Superior beach, and, so far as known, has no parallel in Michigan and Wisconsin. The iron ore of the Animikie slates is hard hematite and magnetite, and probably parallel to the Commonwealth mines of Wisconsin, but without any known equivalent in Michigan; while the Huronian deposits, occurring chiefly about the south end of Lake Vermilion, consist almost wholly of hematite, and seem to agree closely in character and position with the Marquette and Menominee deposits of Michigan and Wisconsin.

The Vermilion Lake mines are being rapidly exploited, and the discovery of these ore-bodies is regarded as marking an epoch in the economic history of Minnesota and the north-west.

The salt-wells of north-western Minnesota and the adjacent portions of Dakota and Manitoba are believed to give promise of important developments; and various facts are cited tending to show, that, although the occurrence of carboniferous strata in this region has not been heretofore definitely known, these brines, like those of Michigan, really have their source in that formation.

Minnesota, it is well known, is, for the most part, deeply drift-covered, and the solid rocks are rarely exposed, except along the principal streams. For this reason, great geological interest attaches to the numerous deep wells which are being drilled in different parts of the state. They not only show what would be the surface rock if the drift were removed, but also establish the order, thickness, and continuity of the different horizons down to the crystalline foundations of the state, at points far removed from their outcrops.

In the deep wells of central and south-eastern

Minnesota, there has been found, beneath the St. Croix sandstone, which has for a long time been regarded as the equivalent of the Potsdam sandstone of New York, some four hundred feet of red and green shales, associated with some red sandstone, and succeeded below by a hard red quartzite. This has been uniformly supposed to be the red quartzite that outcrops in south-western Minnesota and the adjacent parts of Iowa and Dakota, and, in Pipestone county, contains the celebrated red clay, otherwise known as pipestone and Catlinite.

The isolation of the outcrops and the supposed absence of fossils have heretofore left the age of this interesting formation in doubt; but it has usually, in recent years, been referred to the Potsdam, although that reference has appeared very unsatisfactory, in view of the records of the deep borings already noticed. Geologists must therefore regard with great satisfaction the discovery in the Catlinite of characteristic fossils, which is here announced. Two forms have been described and figured under the names Lingula Calumet and Paradoxides Barberi, which are believed to indicate the lowest primordial zone, i.e., the Acadian, which embraces the Paradoxides beds of St. John, N.B., and Braintree, Mass.

The discovery of Acadian fossils in the pipestone establishes an important datum for determining the true horizons of other rocks of the north-west. Thus Professor Winchell has referred the overlying red shales, observed in the artesian wells, with much probability to the Georgia slates of Vermont; and the red sandstones connected with them, which appear to expand toward Lake Superior so as to become the red sandstones called Potsdam by the Wisconsin geologists, really become, in that case, the equivalent of the true Potsdam of New York. This makes it necessary to refer the St. Croix sandstones and associated magnesian limestones to the *calciferous* of New York, with which they are more closely allied paleontologically.

Passing to the other extreme of the geological scale, we find two contributions, by Dr. G. M. Dawson and Messrs. A. Woodward and B. W. Thomas, to the paleontology of the bowlder-clay, or drift. The microscopic examination of the bowlder-clays of Minnesota and adjacent regions shows that various species of Foraminifera and other microscopic forms are very generally present, with fragments of larger organisms.

The more important of the Foraminifera are described and figured. Concerning the real origin and age of these fossils, Dr. Dawson says, "that, of all the organic bodies met with, none can be assigned with certainty to the glacial period or era of deposition of the bowlder-clay itself. The origin of most can be traced unequivocally to the older rocks, from which they have been derived, and incorporated with the bowlder-clays." In Illinois the Foraminifera seem to have been derived chiefly from Devonian shales, but farther west they are characteristic cretaceous forms. Dr. Dawson further points out that while the examination of these drift-fossils will serve to throw additional light on the direction of glacial movement, — a point of particular value over the wide area of the plains, where the soft character of the rock precludes the test of direction of striation, — they have so far failed to afford any certain information as to the actual condition prevailing during that period. But the negative evidence, re-enforced by the fact that the derived fossils have been so perfectly preserved, leads to a belief in the great scarcity of life during the ice age.

The principal feature of the report for 1885 is the bibliography of recent and fossil Foraminifera, prepared by Mr. A. Woodward as an introduction to a contemplated work on the Foraminifera and other microscopic organisms of the cretaceous of Minnesota. The completeness of this work may be judged by the fact that one hundred and thirty-three titles are given for eozoon alone.

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BORNEMANN, in the *Deutsche medicinal-zeitung*, states that the victim of morphine looks to cocaine for help, and, mistaking its effects for those of morphine abstinence, seeks to remove them by more cocaine, until, unless he becomes enlightened, he finally becomes an inmate of an insane-asylum. In three out of six cases known to him, this was the result. He evidently agrees with those members of the medical profession who are endeavoring to restrict its use, by saying, "More urgently than ever in the case of any other drug, are legal regulations and limitations needed for the sale of cocaine, which now, unfortunately, is too easily accessible to every layman."

— There has been of late considerable discussion among physicians in the west as to the nature of mountain-fever, — a fever which occurs in the Rocky Mountain region, and which has by some been supposed to be peculiar to that locality. Dr. Curtin, who has recently been engaged in an investigation of the subject, finds that almost any disease which occurs in the mountains is liable to be called mountain-fever. He regards that disease which is more commonly known by this name as true typhoid, modified by the peculiar conditions of elevation, etc.

# SCIENCE.

FRIDAY, APRIL 29, 1887.

## COMMENT AND CRITICISM.

THE ENGLISH ARE WORKING themselves into no slight excitement over their industrial position. They believe that they are losing ground as a nation, and both statesmen and scholars are looking for the cause and the cure for this unfortunate state of affairs. Lord Hartington and Professor Huxley have recently addressed their countrymen on this topic in a most interesting and suggestive manner. Professor Huxley compared the industrial forces of Europe to the organization of the great standing armies, and he asserted that the industrial competition of the present is really a state of war, though carried on for different objects and with far different results from those of ordinary warfare. "It does not break heads, and it does not shed blood," said Professor Huxley, "but it starves the man who succeeds in the war of competition, and the nation which succeeds in the war of competition beats the other by starvation." Lord Hartington accepted this metaphor as expressing the truth, and drew a most pitiful picture of what England would become were she defeated in this industrial warfare. "The consequences to the nation would be a diminution of wealth and of the influence which we have acquired through our pre-eminent industrial position. What would this country be without its manufactures and industries? No doubt we should still have our material resources, our iron and steel, and the muscular energy of what would then be our superabundant population; but, instead of being where we are now, we should be hewers of wood and drawers of water for the world. If ever our raw materials could be manufactured for the uses and wants of the world better in other countries than in our own, we should become the slaves and servants of the rest of the world, instead of its leaders and masters, as we have been hitherto."

But, Lord Hartington continued, the ill would not be confined to the country as a whole. It would be visited upon individuals. This impending industrial defeat would mean a disastrous change in the circumstances of almost every private person. The result would be "a loss of affluence to those now rich, poverty to those now prosperous, and to the masses of the country to those whose only means of subsistence is the demand for their manual and intelligent labor, it would mean famine, indigence, and starvation.' The speaker asserted that the plain truth was, that, just as in actual warfare, victory in the industrial struggle can only be secured by the possession of scientific knowledge and the application of the most scientific instruction to the masses of the people. At the present time, Germany and France are making enormous efforts to provide adequate technical instruction for the people, and the lesser continental nations are following their example. England is lagging in this respect. Much has been done by the employers of labor, but much remains to be done. Lord Hartington expressed the hope that in every considerable centre industrial and technical schools would be established, suitable to the wants of the particular district. Professor Huxley has since returned to this point, and eloquently urged the necessity of organizing industrial education. He has pointed out what general direction this organization should follow, but has not entered into any details. It is certainly suggestive, however, to find the very first of England's statesmen and scientists uniting in their appreciation of the danger which threatens Great Britain, as well as agreeing that industrial and technical education is the proper means of avoiding this danger.

AS IS THE CASE with most other similar institutions in the eastern states, a considerable share of the work of the Massachusetts agricultural station is purely chemical. The report for 1886 contains the results of some hundred and sixty or more analyses of fodders, dairy products, fertilizers, water, etc.; and this portion of the report is evidently thoroughly good of its kind, and cannot fail to be of service to the farmers of the state. The field and feeding experiments are made more prominent in the report, however, than the chemical work, as befits their greater general

interest; but the impression left by a careful perusal of them is not altogether satisfactory. In some cases a large amount of data has been obtained, as in the feeding experiment; but the results are presented without any adequate discussion, — a too prevalent habit among our stations. Others of the experiments would be more properly called observations, and, while of value, scarcely require the apparatus of an experiment-station for their making; while still others seem to lead to no definite end. While much has been done, and in various directions, we fail to find in the report any exhaustive investigation of any subject, such as it is the peculiar province of the experiment-station to undertake. The tendency appears to have been to select those simpler forms of experiment which give an answer in gross to some question of present interest in practice, rather than to attempt to reduce the question to its elements and elucidate the action of the various factors which enter into the answer.

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PERHAPS NO ONE is better fitted by training and experience to discuss intelligently the problem of municipal government in the United States than Mr. Seth Low of Brooklyn, and his address on this topic before the Historical and political science association of Cornell university is very full of information and suggestion. It has needed neither de Tocqueville's warning nor the data given in the current issue of the *Andover review* to impress upon us the fact that this is the age of great cities, and that it is in the cities that republican institutions will be put to the severest test. Mr. Low points out that the task of administering a large city's affairs is more difficult in this country than in Europe, because of its heterogeneous population and rapid growth. He adds that "the struggle in city government in the United States is not so much to secure the doing of a necessary thing, as it is to procure the doing of it economically, efficiently, and honestly."

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The problem is therefore one in administrative science. The first consideration is to eliminate national politics from municipal elections. In order to this, Mr. Low recommends that municipal elections be held at a time when there can arise no complication between its issues and those of national administration. Then the city charter should carefully separate executive and legislative functions. The mayor should have the power of appointment and removal of executive officers during the time for which he is responsible for the government of the city. The extent to which cities may incur debt should be absolutely fixed by constitutional limitation. All these and several other essentials are strongly urged by Mr. Low. He shows very clearly by practical illustrations just what the lack of such provisions has resulted in. The whole address is thoroughly scientific in character, and leaves the impression that the government of cities is a matter requiring far more intelligence and devotion than it usually has bestowed upon it.

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THE *Sanitary news* reports that the sanitary committee of the Philadelphia board of health has decided that there is no harm in using distillery slops to feed milch-cows when supplemented by more nourishing food. If such action has been taken, it is certainly a step backward in sanitary administration. It is well settled that distillery swill in any amount is an unnatural food for milch-cows, and that the milk produced from animals so fed is unwholesome and injurious. A case is reported by the Brooklyn board of health in which it is believed to have caused the death of a child. Swill acts as a stimulant to the milk-glands, and the quantity of milk secreted is increased, while the quality is depreciated. It is to obtain a greater amount of the product that the dairymen desire to use swill; and a long experience has convinced the writer, that, if this food is permitted to be used at all, it will soon be the principal, if not the sole, food. We sincerely hope that the Philadelphia board of health will reconsider its action, and make a more extended investigation into the subject; for we feel sure that there is ample evidence on record to demonstrate to the satisfaction of any board of health that distillery swill is totally unfit food for milch-cows, even though it is given in restricted amount and in connection with other food.

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## GATSCHET'S ETHNOLOGICAL MAPS OF THE GULF STATES.

MR. A. S. GATSCHET'S researches on the history and ethnology of the Creek Indians have led him to a thorough examination of the available literary material referring to the Indians of the Gulf states. The results of his studies are contained in his book, 'A migration legend of the Creek Indians,' and may be seen by a single glance at the maps pub-

lished in this number. The relations of the tribes are explained by the author in the notes accompanying the maps (p. 413). We wish to draw attention to the importance of ethnological researches of this kind.

Students of American ethnology feel hampered everywhere by the lack of reliable observations and the want of linguistic material. We fully agree with the author, who emphasizes, in the preface of his book, the fact that the method of furthering ethnographic study by all the means which the study of language can afford, has been too little appreciated up to the present time. The careful observer, inquiring into the psychology and ethnological character of a nation, will feel compelled to learn its language as the only means of understanding the way of thinking of the people he studies. But, besides this, the comparison of languages is one of the most powerful helps for studying the prehistoric history of mankind. The material available for a study of the Indians is in part very scanty, and much of it is irredeemably lost, the languages and tribes being extinct. Much, however, might still be saved, if public interest would encourage and support researches in this field. The philosopher cannot but regret the indifference of the public towards these studies, which are the principal foundation of a psychology of mankind. The scientific institutions which take an active interest in this matter are not many, and do not command over-large funds. The bureau of ethnology, which has done and now does most of this work in the field, is hampered by lack of means. Academies and societies are generally more interested in archeology than in ethnology. We wish it might be better understood that the only way to understand the relics of a dead culture is the study of the living one; but we fear the interest in the Indians will not be aroused until they all are buried. Then their irrecoverably lost legends and customs, character and ideas, will seem to grow in value, and much work and money will be wasted in researches that might now be successfully done at a small expense.

It is not too late, however. Much may still be done by intelligent and careful collectors and observers, and we hope that the growing interest in science will also extend to ethnological researches. Astronomers, geologists, students of natural history, are receiving ample support from their rich fellow-citizens. Ethnology may gain friends too, which will enable students to carry on their researches and to collect material before it will be too late.

Gatschet's first map is an attempt to locate the settlements pertaining to the Indians of each of the linguistic families of the Gulf states as far as traceable in the eighteenth century. For this period of the history of the Gulf states, our remarks are particularly true, and our knowledge of many tribes is merely derived from occasional remarks of early writers. Enormous materials of this kind are embodied in the map which shows where the tribes were located. The author prefers to mark the territory inhabited by each tribe by dots, as answering better the purpose than the coloring of large areas, which conveys the impression that the population was scattered all over a certain country. He says (p. 49), "This will do very well for densely populated countries or for tracts inhabited by roving, erratic Indians, whom we meet only on the west side of the Mississippi River. The Gulf state Indians were not longer in the condition of pure hunting tribes; they had settled in stationary villages, and derived the main part of their sustenance from agriculture and fishing." As far as the map is intended to show the exact state of our knowledge, this opinion is correct. The question, however, is not so easily settled. The migrations of tribes, the shifting of villages, hunting excursions, and many other facts and habits, tend to make the territory of a tribe indefinite; while, on the other hand, lands, though not inhabited, are claimed by a tribe as their possession. These are some important points in favor of coloring large areas.

It will be seen on the map that the Maskóki occupied a central position. The large extent of their territory, their numbers, and their character, made them one of the most important groups in Indian history. In former times the tribes probably extended from the Atlantic to the Mississippi, and beyond that river, and from the Appalachian range to the Gulf of Mexico. They kept up a warfare with all their neighbors and among themselves; their main branches, the Creek and the Cha'hta Indians, constantly being at war. The dialects of the linguistic stock greatly differ from each other, the Cha'hta, for instance, being unintelligible to the Creek. Gatschet divides them in four groups, — the Creek, Apalachian (Hitchiti), Alibamu, and Cha'hta. The Creek Indians occupied in historical times a central position among the other Maskóki tribes, and, by forming a strong and permanent national union, had become the most powerful of all the southern tribes.

Their traditions say that they came from the west, and immigrated into their territory in the eastern Gulf states after crossing the lower Mississippi. According to their migration legends, the Kasi'hta and Kawita tribes were the first to reach the Chatahutchi River, where they found the Kusa and the Apalatchukla settled. The situation of these places will be found on the map. All other

settlements on the Chatahutchi River seem more recent than Kasi'hta and Kawita, and therefore it is probable that the Creek immigration to those parts came from the Coosa and Tallapoosa rivers.

The villages of the Creeks are built along the banks of rivers and brooks, frequently in places subject to inundations. They consisted of irregular clusters of houses. Each of these belonged to a gens, or clan, of which there were a great number, twenty of which are still in existence. Only the larger villages had a public square occupying a central position. This was reserved for the celebration of festivals, especially for that of the annual fast, which is the most prominent one among their feasts. On the square stood the council-house. The Creeks distinguished two kinds of towns, — the red or war town, and the white or peace towns. While the former were governed by warriors only, the latter had a civil government. One of the most noteworthy of the peace towns was Apalatchukla. It was considered the mother town of the Creek confederacy. No captives were put to death, no human blood was spilled there. Deputies from all Creek towns assembled there when a general peace was proposed. On the other hand, Kawita-Tallahassi, a few miles north of Apalatchukla, was an important war town. Here the chiefs and warriors assembled when a general war was proposed, and here captives and state malefactors were put to death.

Gatschet's researches on the ancient pathways are of particular interest. A detailed study of trails leading through the country forms an important part of Indian history and ethnography. But unfortunately only very few are traceable at the present time. He describes four trails leading from the eastern states to the Creek towns, crossing the Chatahutchi River by means of fords.

We cannot enter here upon the ethnographic and linguistic details contained in Gatschet's book, but confine ourselves to the foregoing remarks, which will be explanatory of part of the vast amount of information contained in the maps. It must be regretted that the publication of the second volume of Gatschet's work is delayed so long, as it will undoubtedly further our knowledge of North American ethnology as much as the first one has done.

## PARIS LETTER.

M. BROWN-SEQUARD has been elected president of the Société de biologie in place of the late Paul Bert.

The principal conversational topic of scientific interest at present is the particularly significant relationship existing between typhoid-fever extension and the quality of the water distributed in Paris. It is known that Paris receives its drinking-water from three principal sources: very pure and palatable water is furnished by two rivers whose waters are brought into Paris by means of aqueducts, namely, the Vanne and the Dhuys; second-rate water comes from the Ourcq River; finally, Seine and Marne water is, on account of its impurity, especially used for public purposes, — street cleaning and watering, fountains, etc. But, although the last water is generally not mixed with pure drinking-water, it often happens, especially in summer, that the Dhuys and Vanne do not furnish water enough, so that it becomes necessary to use Seine or Marne water. The consequence is, that, some time after this mingling of the pure with the impure water, typhoid-fever becomes much more prevalent. For instance: for seven weeks during which pure water is distributed in the whole of Paris (May 3–June 16), the number of typhoid-fever cases applying to the hospitals is 149. From June 9 to June 20 the Seine water is mingled with that of the Dhuys and the Vanne. During the seven weeks from June 21 to Aug. 8, the cases are 472. The number of cases begins to increase between eighteen and thirty days after the admixture of the impure water. The same relationship exists in most epidemics of typhoid-fever, between the nature of the water-supply and the frequency of the disease. Another very significant fact is, that, in barracks where the water is good (Vanne water), the death-rate from typhoid-fever is only 0.7 per cent, while in barracks (although quite new and very healthy otherwise) where Marne water is used, the death-rate rises (from typhoid-fever alone) to 17 per cent. If these facts are confirmed, — and it is unlikely that they should not be so, since a recent investigator, M. Thoinot, has found the typhoid bacillus in great numbers in Seine water taken at the very place where it is pumped for the municipal reservoirs, — the Paris board of aldermen will have to give up using Seine water, and will be compelled to secure pure drinking-water elsewhere, if it does not wish to be called, with just reason, a cold-blooded murderer, which it seems to be at present. Such a state of things is a shame to a city like Paris, and in an age of science like that in which we live.

The senate committee for the abatement of alcoholism in France has just reported, and proposes that all non-ethylic alcohols shall be excluded from wines and liquors, as they are poisonous. This is very well, but will it be very easy to devise an instrument or a chemical method for the discovery of non-ethylic alcohol in wine or spirits?

The Paris academy of medicine is going to discuss, some time hence, the question of mental overwork; and the results of these discussions,

if carefully prepared and well backed by good documents, will certainly prove most interesting. The evil effects of overwork must certainly be enormous in France, not only from the mental point of view, but also as concerns the influence on physical development; all the more so that gymnastics and sports are not enough sought for and cultivated to counteract the bad effects of mental strain.

M. Levasseur, of the Académie des sciences morales et politiques, has recently published a paper concerning the average length of life in France at the present day and a century ago, in 1789 and 1881. The following table summarizes the data for different periods of life, the numbers indicating the ratios of survivors per thousand: —

| Age. | Before 1789. | 1877-81. | |
|---|---|---|---|
| | Both sexes. | Male. | Female. |
| 5 | 583 | 716 | 744 |
| 10 | 551 | 698 | 719 |
| 15 | 529 | 680 | 703 |
| 25 | 471 | 631 | 657 |
| 35 | 404 | 574 | 596 |
| 45 | 334 | 512 | 539 |
| 55 | 257 | 433 | 470 |
| 65 | 166 | 320 | 362 |
| 70 | 118 | 245 | 291 |
| 75 | 72 | 161 | 199 |

The following table summarizes the ratio of average life length in France, England, Belgium, and Norway, calculated for a thousand infants of both sexes: —

| Age. | France. | England. | Belgium. | Norway. |
|---|---|---|---|---|
| 10 | 681 | 703 | 689 | 780 |
| 20 | 642 | 663 | 635 | 742 |
| 30 | 584 | 604 | 573 | 691 |
| 40 | 533 | 539 | 511 | 635 |
| 50 | 473 | 464 | 440 | 570 |
| 60 | 289 | 370 | 315 | 486 |
| 70 | 249 | 238 | 216 | 349 |
| 80 | 89 | 89 | 75 | 157 |
| 90 | 11 | 11 | 9 | 26 |

It will be easily perceived that the average length of life has increased greatly since a century ago in France, and that it stands generally on a par with that of England, being superior to that of Belgium, but inferior to that of Norway. The pre-eminence of Norway is due not only to the low death-rate of infants, but to that of all ages of life. Other tables show that life is generally longer in females than in males.

M. Armauer Hansen, whose works concerning leprosy are well known, has recently published an interesting paper concerning septicaemia in whales. Near Bergen, each year, one or two Balaenoptera rostrata are regularly caught. The way in which it is done is very simple. The small bay into which the whale has come is shut by means of a net, — this is quite enough to prevent the egress of the animal, — and then the fishermen try to harpoon it. The animal belongs to the fisherman whose arrow or spear has proved fatal. The fatal wound is recognized easily by the fact that all around it there is a zone of mortification some days afterwards. The animal does not die immediately. Some twenty-four or thirty-six hours after the wounds have been inflicted, the animal, which continues roaming about in the bay, seems sick: it comes oftener to the surface to breathe, and is less rapid in its movements. It is then harpooned and hauled ashore. One of the wounds, as before mentioned, is found to be surrounded by a zone of mortified tissues. All the fishermen then dip their arrows and spears into the wound to poison them. In fact, the whales are killed by septicaemia, for both Hansen and Gade have found in the wound a quantity of bacilli, always the same. Cultures of these bacilli succeed very well, and now inoculations upon rabbits are going to be tried. The curious feature of this fact is that this method of whale-capturing has been in vogue for many thousand years, since the epoch of the vikings.

Many interesting books have been published since my last letter. Professor Frédéricq of Liege has published the first volume of the annals of his laboratory. It contains many interesting papers by the able young physiologist and many other scientists.

Professor Hayem has issued a volume on the great therapeutical methods. It is a useful book, in which the philosophy of therapeutics is well expounded. M. G. de Kerville has published a book on evolution. It is a popular but very satisfactory account of the basis of evolution, of the facts adduced in support thereof, and of the difficulties the great Darwinian theory encounters.

It would be useless to say a word in praise of the late Würtz's 'Biological chemistry,' which is now complete. This work is a very good one, clear and precise, as that regretted master always wrote.

V.

Paris, April 8.

## ATHENS LETTER.

THIS has been an important day for American students in Greece, and for the friends at home, of the American school of archeology. The corner-stone of the permanent home of the school has finally been laid, and, after five years of existence without a house of its own, the school will in a few months be commodiously and permanently accommodated. The building, in course of erection under the supervision of Mr. Trowbridge, was planned by Professor Ware of Columbia. It occupies a charming site a short distance east of the palace, on an eminence fronting Hymettus. The land, which adjoins that of the English school, is the gift of the King of Greece, and was obtained chiefly through the exertions of minister Fearn. The building will afford accommodations for the director of the school and for the students, as well as for the library and working-rooms.

This afternoon most of the Americans in Athens assembled about the new building, over which floated the flags of the United States and of Greece. Upon the platform were the United States and British ministers, and representatives of the Greek government, as well as of the English, French, and German schools in Athens. U. S. Minister Fearn, in laying the corner-stone, spoke in earnest words of the importance of the school for classical studies, and congratulated his countrymen that their school would now be on an equal footing, so far as accommodation is concerned, with its sister institutions of other nations. Copies of the Athens daily papers, and a box of Greek, English, and American coins, were put in the stone, which was then formally placed in position.

Minister Fearn was followed by Professor D'Ooge, the present director of the American school, who described its sphere, and spoke of its needs and its resources. M. Dragoumis, Greek minister of foreign affairs, spoke cordially of the work accomplished in Greece by the Americans, saying that "Greece could not forget that the first well-organized schools in Greece were established by Americans." M. Foucart, director of the French school, was unavoidably absent, as was also the well-known architect, Mr. Penrose, head of the English school, who, however, watched the proceedings with hearty interest from the window of the neighboring school, while his part in the exercises was taken by Mr. Walter Leaf of London, whose Homeric studies have made his reputation. Dr. Petersen spoke for the German school, and the proceedings came to an end with a libation in which all the assembled friends participated. The school is now fairly well established, but too little is known of it at home. Unlike the other schools, which are well supported by their respective governments, our school depends entirely on voluntary contributions; and the responses to its appeals have heretofore been in no wise adequate to its needs. Little has been done by way of presenting its claims, save by circulars issued to the various alumni associations, and funds are urgently needed for the successful carrying-on of this most important work.

A sufficient sum has been raised to erect this new building, and nearly enough more to make provision for the permanent director, but a fund is needed for excavations. The school has just decided on uncovering some important ruins north of Corinth, but the money to prosecute the work is not at hand. Friends of classical study should contribute liberally to place this American school on a suitable basis, and enable it to go on unembarrassed with its work. Hitherto the various colleges have taken turns in sending out a Greek professor to fill the post of director for a year. But it is found that considerable time is needed for each new director to become acquainted with his work, and thus much of his year is spent to no advantage to the school. Charles Waldstein, a graduate of Columbia, and more recently director of the Fitzwilliam museum of the University of Cambridge, has signified his willingness to accept the permanent directorship, and will assume control in 1888. The students, of whom there are at present nine, assume all of their own expenses, and all that is now asked for is an amount sufficient to defray the cost of excavations and the annual running expenses. R. A.

Athens, March 12.

## EXPLORATION AND TRAVEL.

### *The Stanley Falls Station.*

During the past few months the Stanley Falls Station has been attracting considerable attention. According to O. Baumann, member of Dr. O. Lenz's African expedition, who staid several months there (*Mittheil. Vienna geogr. soc.*), the station is situated on the west point of a long island which is separated from the mainland by a branch of the river, about sixty feet in width. A path leads from the station to the numerous huts of Singi Singi's village. The island rises gradually from the river; but the right bank of the Kongo is formed by a steep wall like cliff of red sandstone, the strata of which lie horizontally. Its top is covered with luxuriant vegetation, which surrounds Nsaki's village. Tippo-Tip's village is established on two islands above the seventh cataract, the houses being scattered over his extensive plantations. Be-

low the cataract, on the left bank of the river, there are two villages belonging to two of Tippo-Tip's followers, — Nasr and Mvana Nsigi. They are built in the midst of thick woods, which are said to extend three days' journey from the river, and to be uninhabited. The Kongo, which runs at Tippo-Tip's village very rapidly, forms a little above the station the famous seventh cataract which impressed itself so deeply upon Stanley on his journey across the continent. Though the fall is only about six feet high, the impression is grand, on account of the enormous volume of water and the uproar of the tumultuous waves below the falls.

The inhabitants of this district are the Wagenia (Stanley's Wenya); but also Tippo-Tip, with his


STANLEY FALLS.

1. Stanley Falls Station.
2. Singi Singi's village.
3. Nsaki's village.
4. Tippo-Tip's village.
5. Nasr's village.
6. Mvana Nsigi's village.
7. Seventh cataract.

Arabs and slaves, and the station garrison, are established here. The latter was commanded by two whites, and had one hundred and fifty soldiers and working-men. These were composed of so-called Hausa (men from the Guinea coast and the Niger) and Bangalla, men from the upper Kongo, of the same tribe who so furiously attacked Stanley on his descent of the river. Besides these, there were a number of women and children, — slaves taken by Tippo-Tip on his predatory excursions to the north, and sold to the station. Many of the women had become wives of the Hausa: others were working for the station. The men were clearing the dense woods which surround the houses of the station, filling the swamps of the island, and working on the plantations. Bananas, manioc, and maize were grown there. Sweet-potatoes, papaya, and lemons were introduced from the lower Kongo. Tippo-Tip, who has large rice-plantations on the Lualaba and at Stanley Falls, furnished the station with rice. The stock consisted of three cows, several sheep, goats, and some poultry. The climate is very unhealthy all the year round. It appears that the natives, who were employed by the station, were kept as slaves used to be in the southern states.

The Wagenia live on friendly terms with Tippo-Tip, who uses them for boatmen in travelling up and down and in crossing the rivers. They are fishermen. By far the greater part of their food is obtained in weirs built in the rapids and cataracts of the Kongo. Baskets are fastened to a line of heavy poles, which are strengthened by cross-beams, and the fish are carried into them by the rapid current. The fish are smoked, and traded to the inhabitants of the Lindi and Bivere for bananas and other vegetables or for iron spear-heads and daggers. The Wagenia wear teeth in perforations of the upper lip, beads in the nose and in the ears, and rings of copper, iron, or brass round the neck, arms, and legs.

Their trading excursions to the tribes below the cataracts are made in their large canoes, which have a platform for the steersmen on each end. On extensive journeys, they cover the boat with a roof, under which they build a fireplace of clay. It is remarkable that no demoralization through the influence of the Arabs has thus far been noticeable. The latter are ravaging the whole district, particularly the country north of the Kongo, and it may be expected that their influence will spread out still further, now that the station has been abandoned.

*Africa.*

According to *Nature* of April 14, the Swedish government is preparing an expedition under the direction of Lieut. A. Wester, formerly chief of the Kongo Station, Leopoldville. At the last meeting of the Stockholm society of anthropology and geography, Lieutenant Wester reported on the subject. The expedition may probably start next summer, and will be absent about a year, making Kamerun its base of operations. The cost will be about forty thousand dollars.

Mr. Camille Douls, says *La gazette géographique* of April 14, who was sent out by the French government for exploring the Wad-Dra, has been made prisoner by the natives of Cape Bojador. Mr. Tempest, chief officer of the English post at Cape Juby, however, succeeded in releasing him from the Arabs. Mr. Douls has resumed his journey up the Wad-Dra.

*America.*

The field-operations of the geological survey of Canada for the coming season include some important geographical work. The Yukon expedition, of which Dr. G. M. Dawson is in command

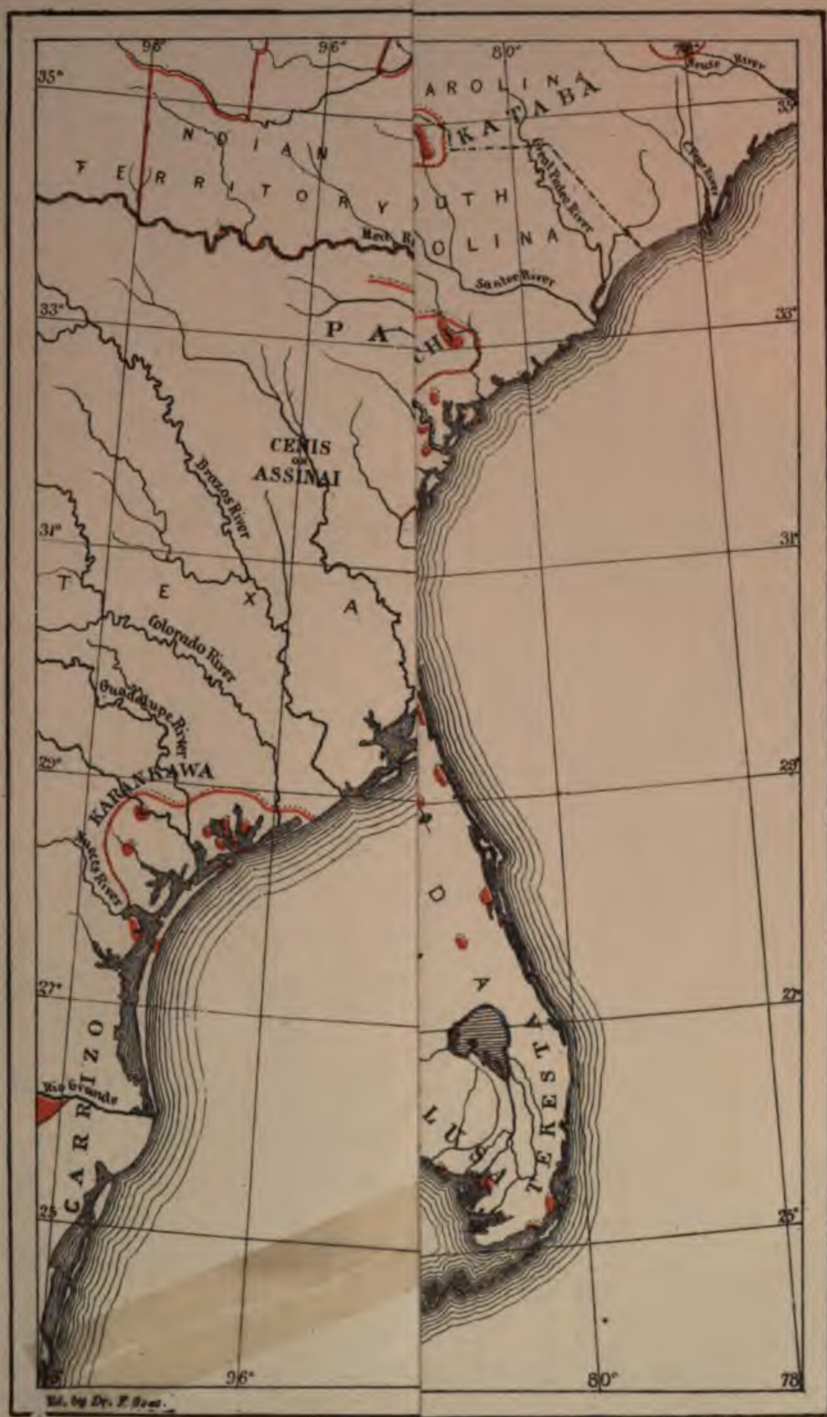
(see *Science*, April 15), set out last week. Dr. Bell will prosecute his researches in Hudson Bay, the south-west shore of which will be examined by Messrs. Low and J. M. Macoun. Professor Macoun will visit the little-known interior of Vancouver Island, principally for botanical purposes. The surveys of Mr. Bowman in the Cariboo gold-fields and the Selkirk range will add considerably to our knowledge of the geography of that district. Messrs. Tyrrell and Dowling will proceed to Duck and Riding mountains to examine the eastern outcrop of cretaceous rocks, and Messrs. Lawson, Smith, and Barrow will survey the boundary-line east of Rainy Lake. The rest of the parties will prosecute mainly geological work in the eastern parts of the Dominion.

Dr. R. A. Philippi gives an interesting report, in *Ausland* of April 11, of an ascent of the volcano Licancaur, which is situated on the eastern boundary-line of the Chilenian province Antofogasta. Former attempts to reach the summit of the mountain have been unsuccessful. Two engineers, Muñoz and Pizarro, attempted to reach the summit of the mountain, which is between eighteen and twenty thousand feet high, in order to make some trigonometrical observations. They experienced, however, so severe attacks of the *punar* (the difficulties of respiration in the rarified atmosphere), that they were prevented carrying out their intention. Their companion, Don José Santelices, succeeded in reaching the summit, and gives the following description: "The 16th of March we reached a tambo on the north-west side of the mountain. These are houses which form a single room with a low stone bank: they were built by the Inkas at regular intervals on their roads. While part of the company could not ascend much farther on account of the rarified air, the guide and myself reached the summit after nine hours' climbing. We descended into the crater, the bottom of which is formed by a plain about thirteen hundred feet in diameter, in which a beautiful pond, four hundred feet long and three hundred and fifty feet wide, is situated. It may be about five hundred feet below the rim of the crater. On its banks there are large stone walls of the houses in which the Indians used to live. There may be about thirty of these. There was a great quantity of fuel which had been carried there by the ancient Indians. An old road of the Inkas, which led to the summit, can still be recognized." Philippi remarks that these houses were probably used by a garrison for watching the approach of an enemy, and for giving signals by lighting the wood. Similar piles of wood have been found on all mountains of that district. Philippi supposes these enemies were the Peruvians, at the time when they made war upon the brave and warlike Calchaquis, who lived in the district of Salta, which belongs at the present time to the Argentine Republic. J. J. Tschudi was probably the first to suggest that the Calchaquis retired to the oases of the Atacama desert, in order to escape the oppressions of the Inkas. This hypothesis is very probable, as the Atacama language is spoken nowadays in some parts of the province of Salta. However, it is not impossible that the Peruvians used these piles of wood for giving notice of the progress of their conquest to Cuzco. Anyhow, the fuel found on the mountains was carried there about four hundred years ago.

## NOTES AND NEWS.

THE papers read at the April meeting of the National academy of sciences were as follows: 'On chemical integration,' T. Sterry Hunt; 'Results of the investigation of the Charleston earthquake,' C. E. Dutton and Everett Hayden; 'On some phenomena of binocular vision,' Joseph LeConte; 'The vegetation of the hot springs of the Yellowstone park,' W. G. Farlow; 'On the fore-limb and shoulder-girdle of Eryops, and on the vertebrates of the triassic,' E. D. Cope; 'On the rainless character of the Sahara,' Elias Loomis; 'The color of the sun,' and 'A new map of the spectrum,' S. P. Langley; 'Chemical constitution and taste,' 'On a new class of compounds analogous to the phthaleins,' and 'On the decomposition of diazo compounds by alcohol,' Ira Remsen; 'On the ancestry of the deaf,' and 'On the notation of kinship,' A. G. Bell; 'On the determination of orbits of planets and comets,' J. W. Gibbs; 'On the serpentine of Syracuse, N.Y.,' G. H. Williams; 'On the barometric oscillation, diurnal and annual,' A. W. Greely; 'On Floridian geology,' W. H. Dall; 'On the Taconic system of Emmons,' C. D. Walcott; 'Is there a Huronian group?' R. D. Irving; 'On the brain of the Ceratodus, with remarks on the general morphology of the vertebrate brain,' B. G. Wilder; 'Outline of the ichthyological system,' Theodore Gill; 'The effect of magnetization on the electrical resistance of metals,' Arthur W. Wright.

— The coast-survey telegraphic longitude parties of Assistants Smith and St. Clair have left for Ogden and San Francisco. Their first work in extending the regular line of standard longitudes of the coast survey will be to connect Salt Lake City with the Franklin Square observatory in San Francisco. When these points are thus connected, the chain will be complete with the Sierra Roblero, New Mexico, near Fort Selden. Assistant

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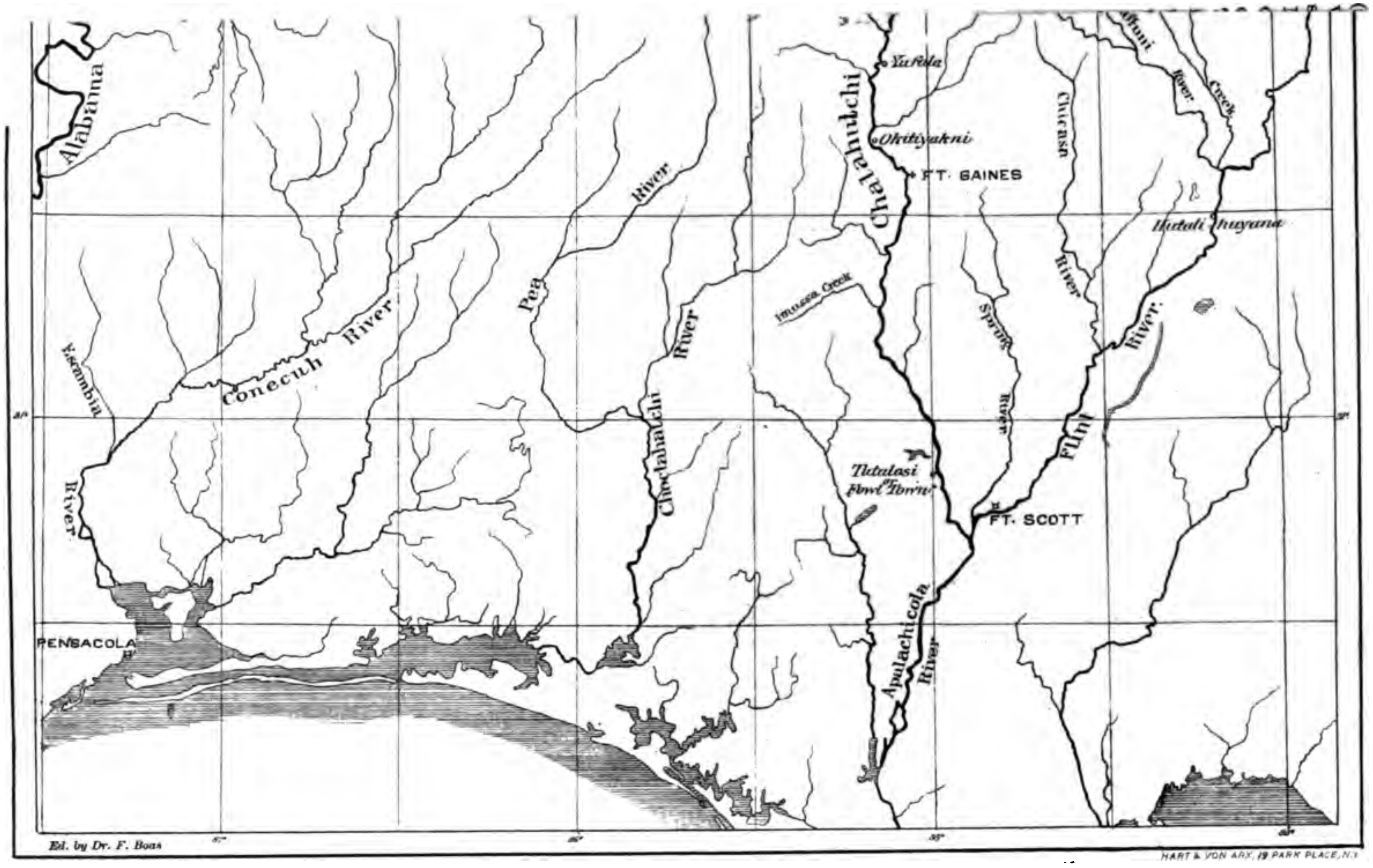



*SCIENCE, April 29, 1887.*

William Eimbeck will continue the transcontinental triangulation from Mount Nebo, near Salt Lake, and is expected to reach that station about May 20. Assistant James B. Baylor has completed his season's work of three months, having occupied twenty-three magnetic stations between Key West and Washington. For absolute measures of declination, dip, and intensity, this is considered good work for stations covering so large an area. In connection with the physical and hydrographical survey of New York bay and harbor, a much-needed work is now progressing, which consists in running a line of precise spirit-levels from the permanent tide-gauge of the coast survey, at Sandy Hook, by way of Keyport, Staten Island, Newark Bay, across New York harbor and the Narrows, up Long Island, through Brooklyn to Long Island Sound, across East River to Governor's Island, and up the Hudson River to Dobbs Ferry. A detailed topographical survey of the west half of the District of Columbia is now nearing completion, the results of which are to be published in atlas form on a scale of four hundred feet to the inch. The Patterson will leave San Francisco, about May 1, for survey-work in Alaska waters, where she will remain all summer.

— Mr. Carroll D. Wright, chief of the U. S. bureau of labor statistics, is now in Massachusetts, collecting statistics as to marriage and divorce in the United States. It will probably be a year before the data can be prepared in the form of a report. The bureau has considerable work in progress at present. The report on convict-labor will be issued in about three weeks. The report on labor-strikes will be ready this fall. Another subject of inquiry now in progress is in relation to the moral and economic condition of working women and girls in the great cities of the country. The bureau will also make inquiries into the cost of the distribution of food-staples, — how the cost of food is increased by transportation-rates, and other facts bearing on the general subject.

## LETTERS TO THE EDITOR.

**** The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Ethnologic results obtained upon an expedition in the south-west of the United States.

IN the subsequent columns I have gathered the results which I obtained in the furtherance of ethnologic studies during a three-months' trip in Louisiana, Texas, and the parts of Mexico adjoining the Rio Grande del Norte.

I left Washington City on Oct. 5, 1886, and stopped on my way to the Mississippi only one day, to view the sites of the ancient Alibamu and Creek towns at the confluence of Coosa and Tallapoosa rivers, Alabama. The authors of the eighteenth century report three towns in the vicinity of the French fort Toulouse, — Odshi-apófa (or 'Hickory Ground'), Taskigi, and Oktchayúdshi ('Little Oktchá-yi').

Accompanied by a guide, I found the French fort, or what remains of it, at about four miles distance from Wetumpka, but several circumstances prevented me from discovering the sites of any of the settlements above named. The authors mentioned give no accurate description of their sites. The whole peninsula is sometimes flooded by high water from the Coosa River, which rises over fifty feet after long rains in the north of Alabama state, and necessarily destroys the vestiges of old habitations; and the country has become overgrown with pine-woods and shrubbery.

At the confluence of Tensaw and Little rivers with Black or Washita River there are four curious mounds in an advanced state of disintegration. One of them is of enormous height, and, as the tradition goes, had once a little pond on its top. According to another tradition, this was the spot where the retreating Natchez Indians defended themselves against the pursuing French troops in 1731. This looks more like the theory of some ambitious archeologist.

Three miles east of Pineville, Rapides parish, La., I then visited the site of a Cha'hta village and cemetery. It lay on the ground which formerly made up Solabella's plantation, and, although the village was abandoned but ten or fifteen years ago, nobody could tell me the Indian name of it. Wherever the chimneys of the cabins stood, there was a little mound or eminence; and upon every grave in the burial-ground stood a plum-tree, which the mourners used to plant to mark the head of the deceased. The main camping-place is now overgrown with horse-mint. The majority of these Indians had gone to a mission in the Cha'hta Nation some time before the secession war, a half-blood Cha'hta chief, Jim Fletcher, having prompted them to go there. Formerly these Cha'htas had annual ball-games with the Biloxis, two hundred of whom inhabited a village on the north-east bank of Red River, thirty miles above Alexandria. The ground is now owned or held by a Mr. Smith, and these Biloxis all went either to the Cha'hta Nation or among the Caddos, Indian Territory.

The Biloxi Indians, whom I saw and studied, live on Indian Creek, five or six miles west of Lecompte, Rapides parish. The unhealthy location of their present abode in the pine-woods, flooded in the rainy season, has of late subjected them to the ravages of fever. There they stay, on the property of Mrs. Martin, and make a living by working for wages. Most of them are small, sturdy people, show no trace of tattooing, and generally speak English more than their native tongue. I studied their language at Lecompte, and found at once that it belonged to the Dakotan or Siouan family. About twelve Biloxis speak or understand it: all the others — fifteen or twenty — know English only. They know nothing about earlier migrations of their tribe,

except that they came from Avoyelles parish, perhaps thirty years ago. They call their own tribe 'Táneks,' 'Tánuks,' or 'Tánks,' but cannot interpret this name. The Tunicas call them 'Yóroni.' The presumption is that the other tribes living in their neighborhood when they were still upon the Gulf coast (Pascagoulas, Chozettas, Moctoby) spoke Dakotan dialects also; and the discovery of the Biloxi language is of great importance, because it upsets the old theory that the so-called Cha'hta tribes of the Gulf coast, or southern Cha'hta tribes, spoke Cha'hta dialects throughout. The Bayagoulas and Mugulashas probably did so; but of the Húmas, Tchaouachas, Tohomes, Tangipahoa, and Opelousas, this cannot be said with certainty. They all used, however, the Cha'hta or Mobilian trade language as a means of intercommunication.

Before the Biloxis on Indian Creek left Avoyelles parish, they lived there peaceably with another tribe, the Tunica. Some twenty-five of these still remain in their old homes on the Marksville prairie, a little to the south-east of Marksville, the parish seat. They are the Tassenocogoulas and Avoyelles of the old documents. In the eighteenth century other Tunica villages existed besides these, — the Tunicas on lower Yazoo River, and those on Mississippi River a few miles below the Red River junction.[1] Those in Avoyelles parish called themselves Shixkaltini, or 'flint people,' after a former chief, as alleged. Of these, I found a young man at Lecompte, from whom I obtained thorough information on his language. The only mode of disposing of the dead among the southern Indians seems to have been that of inhumation.

Comparisons made with the vocabularies of all the languages formerly spoken in the countries on both sides of the lower Mississippi River and its affluents, even with the Páni dialects, as Caddo, Yátassi, Nadaco, Wichita, have shown that affinity existed with none of them, and that therefore Tonica represents a linguistic family for itself. It has many phonetic peculiarities. The sound *f*, which is so frequent in the Maskóki dialects, is wanting here, as well as *v*. Instead of *ts*, *ds*, the language has *tch*, *dsh*. Of trills, we find *l* beside *r* and the uvular *r*, the *r* being not our rolling *r*, but the sound heard in 'mar,' 'bar.' *D* and *b* occur very seldom, and interchange with *t* and *p*, as *g* does with *k*. The surd guttural *k* almost in every instance interchanges with χk. This is done, for instance, in the numeral series, which is decimal, and in the name of the people itself, which may be pronounced 'Túnika' or 'Túniχka,' — a compound of *ta-* (a sort of an article, 'the'), *úni*, or *óni* ('man,' 'people'), and a suffix, *-ka*, *-χka*. The language is nasalizing, though not so strongly as Cha'hta, and is more vocalic than the latter.

In morphology the language is distinct from other southern tongues, 1°, by having a feminine besides the masculine form in the noun, pronoun, and verb; 2°, by having a dual of three persons in the pronoun and the verb; 3°, by the above article, *ta-*, *tĕ-*, *t-*; and, 4°, by a sort of reduplication of the radix in some of the shorter adjectives and verbs, which differs entirely from the reduplication found in the Maskóki dialects. The existence of a masculine and a feminine gender, shown by the appending of *-ku* for the masculine, and *-tchi*, *-'htchi*, *-xtchi*, for the feminine, is extremely curious, and, since it extends to the substantive noun also, finds very few analogies in American languages (northern Tinné dialects, Maya, Carib, and the disputed Taensa). The words for 'woman' (*núxtchi*) and for 'female' (*tĭ'htchi*) contain this suffix also, and, from what I have observed, the term 'feminine' seems better applied here than 'metarrhenic,' which was proposed for similar distinctions by French linguists. I have obtained several highly interesting tales, evidently very ancient, in the Tonica language, with interlinear translation in Creole French.

Being unable to find any person who could reliably inform me of the present whereabouts of the Karánkawa tribe, once upon the Texan coast near Lavaca Bay, I repaired to San Antonio, in Bejar county, Tex. The so-called Mexicans living in and around that rising city, and selling their produce upon the large market-square, have an Indian countenance and expression, with the same ashy complexion which I had previously observed among the Káyowē Indians. They all speak Spanish, but nevertheless I was forcibly struck with the idea that these must be the descendants of the Indians once gathered into the Alamo and the four missions, now in ruins along the San Antonio River, south-west of the city. Our information upon these tribes is so defective that we scarcely know their names. It is surmised, however, that all or some of them spoke dialects of one family, which has been called 'Coahuilteco' or 'Tejano' by Orozco y Berra (1864).

From Laredo, Webb county, Tex., I went south to Camargo, and found, in the vicinity of San Miguel, the terminus of the railroad to Matamoros, the remnants of the Comecrudo ('raw-eating') tribe, who have established their cane-lodges on both sides of the track near Las Prietas. They are commonly called 'Carrizos' by the whites, but insist on being called 'Comecrudos,' the extinct Carrizos having lived at Camargo and north-west of that town. Only the oldest men and women of the Comecrudos remember the language or converse in it among themselves. A part of these Indians formerly lived in the woods to the south, at Charco Escondido. The full-blood Comecrudos seen by me were slim and tall, some of them of a whiter complexion than the Mexicans around them. The pronunciation of these Indians is remarkably clear, and only a few words contain nasal sounds. The language is lacking the sounds *f*, *r*, *tch*, *dsh*, *ts*, *ds*, *b*, and *d*, but diphthongs are frequent. Only two tenses are extant, but the noun is inflected by some cases of a locative character. A demonstrative particle, *pa-* or *pe-*, is found before almost every noun, and in some verbs also. There is also a tendency to oxytonize many words, especially substantives, although the accent shifts, as in other Indian languages.

The same simplicity and paucity of sounds is found in the Cotoname language, formerly spoken in the same district. I could find only one man living who remembered words of it, and I had to visit him several times before he could gather up his recollections so as to rely on them as truthful. As late as 1850 the naturalist Berlandier, who lived in Matamoros, had no difficulty in obtaining a full vocabulary of that language, but I obtained only about one hundred terms. It differs so considerably from Comecrudo, that I thought at first I had secured a representative of a new family, but subsequently discovered it to be a distinct dialectic form of the

[1] These Tonicas were the stanchest Indian friends and allies of the French colonists on the lower Mississippi.

same stock. I could not obtain the numerals in Cotoname, but in Comecrudo the majority of them are borrowed from Nahuatl.

The Comecrudo Indians mentioned to me a number of extinct tribes, who lived in their vicinity, and spoke their language, or dialects closely related to it, but left no representatives at the time of my visit. These were the Casas Chiquitas, Tejones (or 'raccoons'), Pintos or Pakawás, Miákkan, Catujanos, and the Carrizos above mentioned. The Pintos and the Cotonames originally belonged to the northern or Texan side of the Rio Grande. The Miákkan belonged to the Mission de los Borregos, at the town of Mier, and spoke a language that was neither Cotoname nor Comecrudo.

Upon being informed by a French priest at Rio Grande City that a colony of Indians existed at Saltillo, the capital of Coahuila state, I resolved to visit that place. One day's ride upon the railroad brought me there from Laredo. The country between the Rio Grande and Saltillo can be irrigated only in a few places, for want of running water; but if that commodity was procured through artesian wells, or pumped by windmills to the surface, there would be no land more fertile on earth. The ground luxuriantly produces the nopal, guisache, mescal, palm-tree, and *uña de gato* (or 'cat's-claw') tree. The scenery, as soon as the mountain-ridges are reached, at Lampazas, is of extraordinary grandeur, the effect being heightened by the transparency of the southern atmosphere. Beyond the city of Monterey the railroad-track begins to wind up along the tortuous passes of the Rinconada, once held and strongly defended by the wild tribes of the Guachichile Indians; then it emerges into a wide, dry plain, in the midst of which Saltillo (literally, 'the small water-spring') is situated, surrounded upon all sides by the high mountains of the Sierra Madre. In this city of about 42,000 inhabitants, the Tlaskaltec Indians, said to count about a thousand souls, live in some of the eastern thoroughfares, and in early colonial times were allotted the whole eastern quarter of Saltillo, which was founded about A.D. 1575. Over a hundred and fifty families of these Indians were then brought to this distant place from Anahuac to defend the new colony against hostile tribes, such as the Guachichiles and Borrados, who seem to have disappeared entirely since the eighteenth century. The Indians, who now speak the Tlaskaltec language, which is almost identical with Aztec, do not number over two hundred. The language has adopted as many Mexican-Spanish terms as English has adopted words from Norman-French, or perhaps more. *La planta de mókshi* is 'sole of the foot;' *huesito de nókshi*, 'ankle-bone;' *se chorrito de atl*, 'a cascade;' *cerca de naxkoyóme*, 'around the city.' Tlaskaltec has also lost many derivational endings from the old Nahuatl, as in *nenépil*, for *nenépilli* ('tongue').

It is quite probable that the linguistic family to which the tribes on the lower Rio Grande belong extended once to Saltillo and the rest of Coahuila, or at least to the western slope of the mountain-chain forming the Rinconada passes. But no vocabularies of these tribes are now extant, and we have to expect the concluding numbers of a publication now issued at Saltillo by Mr. Esteban Portillo, which will perhaps shed more light on this subject. The title of this book is 'Apuntes para la historia antigua de Coahuila y Texas' (Saltillo, 1886, 8°). This title is explained by the circumstance that Texas once formed a part of the local government of Coahuila, which, from the sixteenth to the eighteenth centuries, comprised a much larger extent of territory than it does now. ALBERT S. GATSCHET.

## Two ethnographic maps.

### LINGUISTIC FAMILIES OF THE GULF STATES.

THE annexed map represents the linguistic families of Indian dialects within the south-eastern parts of the United States of America, as far as they could be traced through actual remnants of tribes still lingering in their old haunts, or in the vicinity of these, and by historic research. As far as the smaller stocks are concerned, their areas, or the probable limits of the territories claimed by them, are shown by lines, mostly of a rounded shape, enclosing their principal settlements, which are marked by colored dots. Full ethnographic and historic particulars of these linguistic families will be found in my publication, 'A migration legend of the Creek Indians' (1884, vol. i. pp. 11–118). In the present article I restrict myself to a few remarks necessary for the understanding of the map, and begin with the family of the

*Timucua.* — This Floridian stock, properly called Atimuca, extended north to a line which can be indicated only approximately, and seems to have extended farther north on the Atlantic side than on the western side towards the Chatahutchi River. It is very probable that the Kalúsa and Tekesta villages at the southern cape of Florida spoke dialects of Timucua. Tribes speaking Creek and Hitchiti dialects had intruded upon the Timucua domain since 1550 (perhaps before); and from 1706 to the present time they have inhabited its whole area, under the name of Seminoles.

*Kataba.* — The dialects of this family, which does not properly belong to the Gulf states, must have occupied a much larger area than is indicated by the two rings on the map. But since we possess but two vocabularies, Katába proper and Woccon, these alone could be indicated in the map, for fear of infringing against historic truth.

*Yuchi.* — From historic documents, three areas could be made out for this people, which never appears prominently in history. Of these, the settlements on Chatahutchi and upper Flint rivers were the most recent. Other Yuchis existed between the Altamaha River and the northern border of Florida. In the Creek Nation, Indian Territory, they occupy a tract near Wialáka and Deep Creek, on the south shore of the Arkansas River.

*Cheroki.* — The settlements of this people were divided into Otali or Otari ('upland' or 'overhill') towns, and Elati or Erati (or 'lowland') villages, the latter in upper Georgia and Alabama. The limit between the Cheroki and the Maskóki family is marked approximatively. The land cessions made by Cheroki Indians to the United States government are given in detail in C. C. Royce's 'Map of the former territorial limits of the Cherokee Indians,' etc., issued in the 'Fifth report of the bureau of ethnology,' with his article on the same subject (pp. 123–378), now in press.

*Arkansas*, properly called *Ugáxpa* (or 'down-stream') tribe, speaks a dialect of the great Dakotan or Sioux family. The subdivisions of this tribe now live in the north-eastern angle of the Indian Territory. The Biloxi, formerly on the Gulf coast, state

of Mississippi, speak a dialect of the same Dakotan stock. Some of their remnants I met in November, 1886, on Indian Creek, near Lecompte, La.

*Maskóki.* — This family is the largest of all represented upon the map, and from the sixteenth to the eighteenth century extended even east of the Savannah River (Yámassi tribe). The Yuchi were surrounded on all sides by the Maskóki tribes, and one of these, the Seminoles, settled in Florida in the former domain of the Timucua, and west of it, where formerly the Apalaches lived. The upper and lower Creeks held the central parts of the area; and the Cha'hta, in three subdivisions, the western parts. The Biloxi, on the coast, belong to the Dakota stock. The majority of the Maskóki tribes now live in the eastern parts of the Indian Territory, within the area marked with red lines in the north-western corner of the map.

*Taensa.* — The historic Taensa people were settled at two places. From their earlier settlements on the Mississippi River, west side, between Vicksburg and Natchez City, they removed to Mobile Bay, threatened by an attack from the Chicasa Indians, early in the eighteenth century. In 1762 they went to Louisiana with the Alibamus, and are mentioned there, on Bayou Boeuf, as late as 1812, by the Rev. Mr. Schermerhorn (*Mass. hist coll.*).

*Naktche.* — This family were the leading people in the confederacy of Theloël, on St. Catherine Creek, near Natchez City, Miss. Since the war of 1730 they have lived scattered in various countries.

*Tonika*, or, as they call themselves, *Túnixka*, a people once residing at different places near the lower Mississippi River: 1°, on the lower Yazoo River; 2°, on the east shore of the Mississippi River, near the Red River junction; 3°, in Avoyelles parish, south of the lower Red River, Louisiana. I studied this vocalic language, new to science, in November, 1886, and found it to be independent of all other North American families.

*Adá-i.* — A small people once living between Sabine River and Natchitoches, La., which is still remembered as belonging to the Caddo confederacy.

*Caddo* of north-western Louisiana, and the Assinai or Cenis of middle Texas, spoke dialects closely related to each other, and, with six or seven other tribes, formed a confederacy, the remnants of which now live near Washita River, on the Kiowa, Apache, and Comanche reservation, Indian Territory.

*Shetimasha.* — The few Indians of this family still live at one of their old seats, at Charenton, St. Mary's parish, La., while others are farther north on Plaquemine Bayou.

*Atákapa.* — This language seems to have had a pretty extensive area in earlier centuries, for Dr. Sibley stated in 1805 that the Karánkawa Indians of the middle Texan coast spoke Atákapa, besides their own language. At present only two dialects are known, both in south-western Louisiana.

*Karánkawa.* — A people of the Texan coast, and settled there until the middle of the nineteenth century. Of their language, only twenty-five terms are known, published in *Globus*, a geographic magazine of Braunschweig, 1886 (pp. 123–125, vol. xlix.). The classing of this language as a separate family is only provisional.

TOWN-MAP OF THE OLD CREEK COUNTRY.

The numerous towns marked on this map from authentic documents subdivide themselves into towns of the Upper Creeks on Coosa and Tallapoosa rivers, and of the Lower Creeks on Chatahutchi and Flint rivers. The Koassáti and Alibamu towns lay on Alabama River, below the Coosa-Tallapoosa junction. Witúmka, at the Coosa Falls, which was an Alibamu town, made an exception, being on Coosa River. On Chatahutchi River the upper towns spoke Creek; the lower ones, from Chiaha downward, spoke Hitchiti; Yuchi and its colonies on Flint River spoke Yuchi.

Many Creek towns mentioned in history could not be inserted here, because their location is not known with accuracy, like Tallipsehogy, Chunúnagi, Chatoksofki, Koha-mutki-kátska, etc. Others had to be omitted for want of space in crowded parts of the map.

The towns are described in my publication above mentioned (pp. 124–151). Names still used at present are written in capitals on the map. All names of this and the preceding map are spelled according to my phonetic system of alphabetic writing.

ALBERT S. GATSCHET.

## Specific variations in the skeletons of vertebrates.

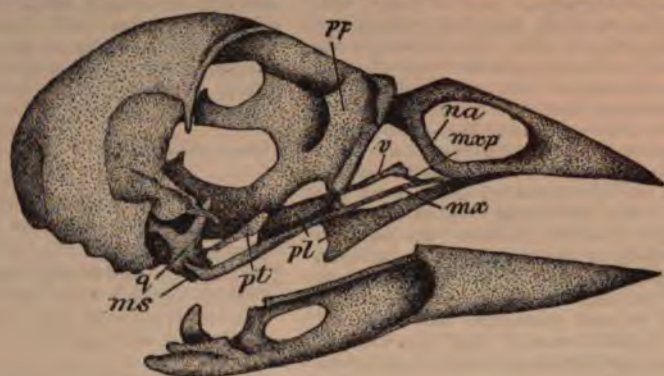
When I speak of the specific variations as they occur in the skeletons of vertebrates, I refer to those appreciable differences in form which we find to exist when we come to compare any two skeletons of the same species, or, as for that matter, a series of skeletons of the same species. As in every thing else, as we are well aware, no two skeletons, even of the same species, are exactly alike; but I have reason to believe that it is not generally appreciated how great this degree of difference may be sometimes. It has always been one of the chief drawbacks to the study of human craniology, that the skulls in *homo*, representing the same race, have frequently been found to be so thoroughly unlike, both in measurement and in general characteristics. We would come across skulls of Caucasians, with wonderfully low cranial capacities, a small facial angle, and, indeed, having perhaps many of the racial characters as they might occur in the skull of a Malay. It will be my object in the present letter to show that these differences are quite as marked among the species that go to make up the classes below man, as they are among the skeletons of the same species of men; and I will also present a number of examples chosen from the lower vertebrates to illustrate this point.

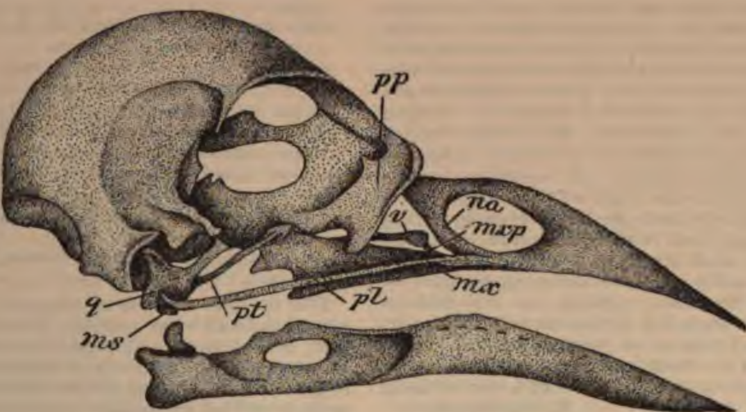
People who have given no special thought to this matter are led to believe that when they have carefully described the skeleton of any vertebrate, such a description will answer for the skeleton of that species for all time, provided specimens of the same age and habitat be chosen for comparison, and the original description was accurately recorded. Such persons have often amused me by the great stress they lay upon the numerous measurements they make, and the extraordinary pains they take to have them of hair-splitting accuracy for the skull or other parts of any skeleton they may be describing. These measurements, of course, are of very great importance, but we must bear in mind always that they are really but fractions of some standard which we should aim to eventually obtain in every case; by this I mean a standard obtained, say, by taking the

average of the measurements secured from fifty or more skulls or other parts of the skeleton. So, too, with our *descriptions* of such material, for we must remember, that, as important as the detailed account of the skeleton of any species of vertebrate may be, it will in no case exactly apply to the skeleton of another specimen of the same species, every thing else being equal.

This being the case, we should endeavor to have before us as large a series as possible of skeletons of the particular form or species we may be describing with the view of giving a published account of its osteology to the world. When this is the case, it is sure to reveal its advantage in our account by the character of our description, and the weight we attach to the length of a process here, the form that a certain part may assume there, or the size, presence, or absence of vacuities and foramina, and similar details. To better illustrate my meaning, I would cite the following example: last winter I published in the Proceedings of the Zoölogical society of London a contribution to the comparative morphology of the swifts, humming-birds, and goatsuckers; and among the figures in the text was a drawing of mine, twice the size of life, giving the basal aspect of the skull of our violet-green swallow (Tachycineta thalassina). This drawing is perfect in all its details, and the subject was chosen from a series of a number of others. Notwithstanding this, fault was found with it in certain quarters, and it was said that the maxillo palatines of the specimen were broken off, whereas in reality nothing of the kind had happened, the specimen being an unusually perfect one, although in it these parts were shorter than they commonly occur. (I have since learned with regret that the person who had this fault to find, for it did not constitute criticism, had not a single specimen of the species before him, or available, at the time he published his remarks!) Students of human craniology who have studied long series of skulls from individuals of the same race, will at once appreciate the point I desire to convey here; for how often do we find, say, in one skull, a styloid process, for example, perhaps an inch or more in length, whereas in another specimen from the same series it will be represented by the most insignificant apophysis imaginable!

For a number of years past I have been collecting material to illustrate the very point about which I am now writing; and among this material I find




RIGHT LATERAL VIEW OF SKULLS OF X. XANTHOCEPHALUS (× 2).

*pp*, pars plana; *na*, nasal; *mxp*, maxillo-palatine; *v*, vomer; *mx*, maxillary; *pl*, palatine; *pt*, pterygoid; *ms*, mandibular sesamoid; *q*, quadrate.

long series, amounting to fifty or more in some cases, of skulls of such forms as our western meadow-lark (S. M. neglecta), or our red-winged and yellow-headed blackbirds (A. phoeniceus and X. xanthocephalus). It will be impossible to detail here the differences which are to be found in these highly instructive series, as they occur for the several respective species mentioned; but I herewith present drawings which I have made (× 2) of two skulls chosen from a series of skulls of our yellow-headed blackbird (X. xanthocephalus) to illustrate the point under consideration. One of these I collected at Fort Wingate here, last July (1886), and the other in Wyoming in 1879. The former is the upper figure, and the lower the latter; and a glance at them will be sufficient to convince us of the extraordinary differences that obtain between them, both as regards measurements and the general form of their several parts. Similar differences are to be found in the other species alluded to above: indeed, they hold good for the skeletons throughout the vertebrate series. No less marked variations are to be found, when we come to examine sufficient material, in the sternum of the same species of birds. I have already pointed this out for the American vultures in my 'Contributions to the anatomy of birds,' published several years ago, and extracted from Hayden's 'Twelfth annual' (p. 771), wherein we find some striking differences in this bone, more especially in its xiphoidal extremity. My collection also affords examples of similar variations in the pelves of birds of the same species; and I have two pelves before me of X. xanthocephalus, wherein in one the ilia meet on either side for a considerable distance the neural crista of the dorso-lumbar vertebrae, while in the other the reverse condition obtains, and they are separated from that median plate of bone, on either side, by a very decided interval. But space here will not admit of further citing interesting examples of these variations; nor is it necessary, for, in the light of those already presented, the entire ground may be covered by saying that in all forms, both vertebrate and invertebrate, paleontological and otherwise, when we come to compare sufficiently extensive series represented by individuals of the same species, we will find in similar structures marked variations both as regards relative size and form as we pass from one specimen to another, and if extremes be chosen the differences will be found to be in many cases of a very striking nature.

R. W. SHUFELDT.

Fort Wingate, N. Mex., April 15.

## International congress of geologists. — American committee meeting at Albany.

At a meeting of the American committee (elected by the standing committee of the American association for the advancement of science to represent American geology in the International congress of geologists) held in Albany on April 6, there were present Prof. James Hall (president), Professors Hitchcock, Stevenson, Williams, Winchell, Cook, Cope, and Frazer (secretary). Professors Emerson, Smock, and Clarke, Dr. Rominger, and Mr. Beecher were invited to be present at the sessions of the committee. By unanimous vote, Mr. W. J. McGee was invited to take the place, during the meeting, of Major Powell, who was prevented by sickness from attending.

The secretary announced that there had been forty-five subscribers for fifty copies of the geological map of Europe.

A motion was adopted, abolishing the committee of the whole and its officers, and intrusting the duty of preparing reports on the separate divisions of the geological column to eight 'reporters,' who were thereupon unanimously elected (see circular letter to geologists, below).

The following was adopted by the committee: —

*Resolved*, that we recommend to American geologists the acceptance of the conclusions of the International congress; said changes to be formulated at a subsequent meeting of the committee; and it being understood that the committee will present such additions as are deemed necessary by American geologists, to the Congress of London in 1888.

PERSIFOR FRAZER, *Secretary*.

Philadelphia, April 22.

[To all American geologists.]

At the recent meeting of the American committee in Albany, 'reporters' were elected whose duty is to prepare reports on the several parts into which, for convenience, the geological column has been divided. The assignment is as follows: —

- Quaternary, recent, and archeology, Major Powell, director U. S. geological survey, Washington, D.C.
- Cainozoic (marine), Prof. E. A. Smith, state geologist, University of Alabama, Tuscaloosa county, Ala.
- Cainozoic (interior), Prof. E. D. Cope, 2102 Pine Street, Philadelphia, Penn.
- Mesozoic, Prof. G. H. Cook, state geologist, Rutgers college, New Brunswick, N.J.
- Upper paleozoic (carbonic), Prof. J. J. Stevenson, University of the city of New York.
- Upper paleozoic (Devonic), Prof. H. S. Williams, Cornell university, Ithaca, N.Y.
- Lower paleozoic, Prof. N. H. Winchell, state geologist, University of Minnesota, Minneapolis, Minn.
- Archaean, Dr. Persifor Frazer, 201 South 5th Street, Philadelphia, Penn.

It is the duty of these reporters to obtain as complete information as possible, each for his own subject, from American geologists interested in it; but, on account of the difficulty of ascertaining the names of all who have information to impart on a particular topic, it will not be possible to address letters to more than a few of those who are known to have studied a subject. For this reason each of the undersigned appeals to *all* his professional brethren for aid in preparing the report which is intrusted to him. It is not possible that any single scheme will be approved by all geologists, and therefore it is the more necessary that there should be a fair statement of any opposing views in each report. These reports will be submitted to criticism and discussion at the next meeting of the American committee, to be held probably next August; and an effort is being made to have them discussed formally in Section E at the meeting of the American association for the advancement of science, to be held afterwards. With such advantages for knowing the views of our countrymen, there seems every prospect that the American representation at the next congress will exercise an influence proportional to the importance of its constituency.

Geologists who have convictions as to classification, nomenclature, coloration, or any of the numerous subjects brought before the last congress (which are similar to those to be brought before the next): or who believe that the congress has erred in any of its recommendations: or who have original observations or deductions bearing upon any part of the seven subjects above assigned to reporters, are earnestly requested to communicate their views as soon as possible to the reporter having in charge the subject to which they relate. Those who neglect to do this cannot justly complain if their individual views are neglected in the reports.

GEO. H. COOK,
J. J. STEVENSON,
H. S. WILLIAMS,
N. H. WINCHELL,
E. D. COPE,
EUGENE A. SMITH,
PERSIFOR FRAZER,
*Reporters of the American committee, International congress of geologists.*

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## Instruction in natural history.

The recent discussion in the columns of *Science* on the teaching of natural history has revealed so wide a difference of opinion, and leaves the question in so unsatisfactory a state, that an additional word may not be out of place. It seems clear that no discussion of special methods can advance matters until naturalists reach some agreement as to the general educational uses of the biological sciences, yet the lack of such agreement is a conspicuous feature of the series of letters with which we have been favored.

It will probably be agreed that a college course in zoölogy or botany should aim, first, to arouse an interest in animals or plants, and to impart clear and accurate knowledge of them; and, second, to cultivate the power of independent observation. But, after agreeing that both these ends must be held constantly in view, we must still decide which of them shall be foremost. Which is the higher ideal of scientific study, — to have students, first of all, learn to use their own eyes, and not simply to verify some one else's description, or to weigh and discuss the nature, meaning, and causes of the relative affinities of organized beings? It is plain enough that independent observation by the student is the only method that can give life and reality to the study. It is no less certain that a main claim of natural history to a place in education rests on the value of the training afforded by observation; and we have the explicit statement of high authority that 'the first thing is to learn to observe.' But, in full view of these facts, let us suppose that an intelligent non-specialist has the hardihood to ask, "*Is* observation the first thing; or is it not, after all, a *means* rather than an end in itself?" Unless we are ready to admit that natural history is a mere drill, the answer must be that its real aim is to teach something, first, of the special phenomena of life; and, second, of the generalizations of biological science illustrated by them; and the problem to be solved is how to make this instruction most effective as an instrument of education.

Now, it is undoubtedly an effective lesson to the future naturalist to be made to stare at one dead fish for three long days, and to classify Haematon solely by the light of nature; but is such a lesson likely to develop the latent scientific tastes and capabilities of the average college sophomore? I think not; and, while no one would seriously advocate such a method for college classes, it may reasonably be asked whether the reaction against the dull and barren cramming of text-books may not sometimes carry us from one extreme to the other, and even close our eyes to the fact that the student of natural history is a rational being, who really possesses a degree of common sense comparable with that of students of other sciences.

It is my decided opinion as a practical instructor that the methods so successfully employed in elementary instruction in physics and chemistry may guide us to the true method of teaching natural history. No teacher of chemistry would commit the absurdity of setting apparatus and chemicals before the beginner and directing him simply to 'experiment.' It is generally admitted that the beginner should receive precise and somewhat detailed instruction before or during the laboratory study, and that he is thus enabled to work with interest and intelligence, and to *gain time*, without loss of independence. It would be hard to find any valid reason why this is not equally true of the beginner in botany, zoölogy, or physiology. Moreover, every teacher knows that students possessing a good degree of mental power and general intelligence are not seldom more or less deficient in those practical capabilities collectively known as 'gumption.' Why should such students be compelled at the outset to fritter away valuable time in the discouraging attempt to make independent observations, which usually result in vague and confused ideas and a distaste for the study? I believe that *beginners* in natural history should be prepared for the laboratory by a clear and tolerably full account of what they are to do and see; and the more books and figures they have, the better. Afterwards, when the strangeness has worn off and a certain facility has been acquired, students can be led naturally and easily to depend more and more on themselves, and to find a pleasure and profit in independent work that was impossible at the start. Whatever be the comparative merits of such a method, there is no doubt, as a matter of experience, that it arouses interest, and gives fulness and accuracy of knowledge; that it saves time for the student, and cerebral protoplasm for the instructor, and as a matter of fact does *not* make students slavishly dependent on books or demonstrators, but, on the contrary, tends to develop independence and originality. It has been said, truly enough, that you cannot teach a boy mountain-climbing by taking him up Mount Washington on a railway. Neither can you teach him by leaving the youngster at the foot of the Alps with the parting injunction to climb immediately to the top.

X.

April 25.

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## Barometer exposure.

The question of barometer exposure has been prominently brought to the front by *Science*. On the one hand, it has been claimed that the wind, in blowing across the mouth of a chimney, would at times produce a vacuum amounting to .10 of an inch; and, on the other, it has been denied that any marked effect would occur, as the air would flow in through cracks, especially on the windward side, and fill up the partial vacuum, if such were

formed. Most of the observations relied upon for proving this effect have been the traces of a barograph recording upon Draper's principle, and there have been very few actual observations of a barometer. Quite recently there have been observations of a barometer, under varying conditions, on Mount Washington, with wind-velocities of eighty and ninety miles. The results have been published in the *Monthly weather review* of the signal service, for February, 1887, and are so interesting that a brief review of them is here given. The chimney in the signal office on Mount Washington is about two feet square, and has three inlets into the office-room. One of these is a ventilator near the top of the room, and the other two have stove-pipes running from three stoves. It is quite evident that the chimney has a fair communication with the room. The experiments consisted in reading a mercurial and an aneroid barometer, 1°, chimney closed; 2°, chimney opened; 3°, same as 1°; 4°, leeward window open; 5°, same as 1°; 6°, windward window open; 7°, same as 1°. The successive readings were made quite rapidly, though generally three or four minutes elapsed between each of the seven conditions. Five sets are published with the wind from sixty-five to ninety miles per hour. Under 2° (chimney open), the pressure fell twice mean —.0065 of an inch, and it rose three times mean +.0037. Under 4° (leeward window open), four times the pressure fell —.019, and once it rose +.002. Under 6° (windward window open), the pressure rose mean .043. Making due allowances for imperfect connection between the chimney and the room, it must be admitted, I think, that there is no evidence of a partial vacuum being formed by the suction of winds, up to sixty-five and ninety miles per hour, blowing across the chimney.

The most interesting results, however, are those with the window open to windward. In an eighty-mile wind, experiment would indicate an increase of pressure of about .44 of an inch, but here we find the total effect one-tenth of that. It seems to me that the effect of wind on the barometer has been much exaggerated, and we may rest assured that our observations during very high winds have not been vitiated so very much. It may be of interest to note that this same slight 'pumping' or uneasiness of the barometer was noted by Mr. Beall, the observer on Mount Washington in 1883. In making his comparative readings of the station and extra barometers at the end of each month, he found it necessary to exercise the utmost care and speed in order to make correct readings during very high winds. The total oscillation seldom reached .01 of an inch.

H. ALLEN.

Washington, D.C., April 25.

### The barometer during thunder-storms.

My attention has been called to the fact that the time given for the squall of July 21, 1885 (printed '1886' by mistake in your last issue), did not agree exactly in time with the sharp depression of the barometer shown on the diagram accompanying my letter on p. 392. This was due to an error in the barograph clock, which was then new, and not well adjusted. Mr. Alexander McAdie, who had charge of the station on that day, and Mr. Frank Brown, were watching the barograph during the squall, and both state that the depression of the barograph was coincident with the occurrence of the squall. The squall was so violent that Mr. McAdie wrote that 'life for a while did not seem certain.'

H. HELM CLAYTON.

Blue Hill meteor. observ., April 23.

### The source of the Mississippi.

I am in receipt of a pamphlet, entitled 'The source of the Mississippi,' from Ivison, Blakeman, Taylor & Co., and am pleased to see therein that the laurels deservedly won by Nicolett and others are maintained to them. My father, Bazil H. Beaulieu,— who had charge of a trading-post on Lake Itasca in 1846 for the American fur company, and who in 1847 accompanied, as assistant geologist, the first geological party (Dr. Norwood, Whittlesey, and others) that went over and drafted Itasca and Elk lakes in going to Red Lake, and went over the lakes again on their return, and also drafted the Mississippi from its source to Dubuque, Io., — concurs in the opinion, as established by the late survey, that Nicolett was the first man that gave to the world of science a faithful and honest report upon, and maps of, the source of 'Gitche-tebe' (or 'mighty-water') River, — the Indian term for the Mississippi. It certainly seems shameful that the vain ambition and venturesome spirit of the Captain Glazier stamp should seek at this late day to aspire to and appropriate to itself laurels nobly won by deserving men in the cause of science half a century ago.

THEO. H. BEAULIEU.

White Earth, Minn., March 21.

# SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 29, 1887.

## HEALTH MATTERS.

### *A theory of consumption.*

THE origin of consumption continues to be a subject of discussion and also of experimentation. Several theories have been advanced and evidence adduced for their support. The older idea was that the disease was hereditary, and that one in whom the 'seeds of consumption' were planted, as it was expressed, was already condemned. Subsequently the dampness of the soil was declared to be the principal factor in producing the disease. Still more recently the theory of contagion has been developed, and the bacillus tuberculosis has been regarded by Koch and his followers as its germ. While there are some who maintain that heredity is never to be considered as a factor, the majority of physicians are not prepared to accept this, even though they may be inclined to look upon the bacillus as playing the principal *rôle*.

During the past year a fourth theory has been advanced by G. W. Hambleton, licentiate of the King's and Queen's college of physicians, Ireland. The theory that consumption is caused by climatic conditions, changes of temperature, or wetness of soil, he combats most vigorously. Instead of being limited to, or even more prevalent in, any particular climate, he finds it co-extensive with the civilized world. That it is more prevalent below than above certain altitudes does not help the theory much, for within these same limits are found living the vast majority of the human race free from the disease. At Madrid and certain cities in South America which are at high altitudes, phthisis exists, while among some Asiatic tribes inhabiting districts lying below the sea-level, it is unknown. In cold climates, as Canada and Sweden, there is little consumption; and the same is true of those classes most exposed to cold in all regions. In the severe winter of 1854–55, fewer men died from it in camp at Sevastopol than in the barracks at home. In France, consumption prevails least in that department which has the dampest soil; and in Lincolnshire, as drainage is introduced, the ague disappears, and consumption takes its place. In reference to the bacillar origin of the disease, he claims that neither physicians, clinical clerks, nor nurses, who are constantly exposed to the bacilli, have ever been known to become phthisical through attendance at hospitals where consumptive patients are treated.

Wherever civilized men permanently congregate, whether on the level of the sea or at any altitude, in every part of the world, irrespective of what is called climate, there consumption is to be found or speedily makes its appearance. The natives of America, Africa, and the South Sea Islands were entirely free from consumption till they came in intimate relationship with civilized Europeans. Even now in the interior of Africa there are tribes, who have not come in contact with civilized men, that are absolutely free from this scourge. Phthisis is a disease of civilization, and in the conditions of civilized life must be sought an explanation of its cause. Those dwelling in cities are more affected than those living in the country, and those engaged in sedentary occupations than those living in the open air, consumption being remarkably low in agriculturists and fishermen, and rare among gypsies. The military life ranks high in the list of those occupations that are favorable to consumption.

The explanation given by Mr. Hambleton of these facts is, that man, in a state of civilization, does not hold himself erect: he stoops more or less. The weight of his shoulders is thrown on the thorax, and consequently the latter is impeded in its movement, and his chest is narrow. Man, in the uncivilized state, holds himself erect; the weight of his arms is borne by the spine; his chest is broad, well developed, and freely movable; and he passes the whole of his existence in active exercise in the open air. The trades and occupations that supply the greatest number of cases are those in which small particles of various substances are constantly inhaled, those that necessitate little movement or even a cramped position of the chest, and those where a considerable time is spent in small and badly ventilated rooms. In the army those who become phthisical are those who have a chest capacity below the average. In short, the conditions that produce consumption are those that reduce the capacity of the lungs below a certain point.

In support of this theory, Mr. Hambleton gives the results of some experimental investigations which he has made, in the form of the following propositions: 1°. That artificially induced reduction of the breathing surface of the lungs below a

certain point, together with the prevention of compensatory action of other organs, is followed by a local and general state not to be distinguished from consumption; 2°. That arrest of this artificially induced reduction of the breathing surface of the lungs, together with induced compensatory action of other organs, is followed by relief of the prominent symptoms, and improvement of the general state; 3°. That artificially induced full development of the breathing surface of the lungs is followed by an entire absence of all symptoms of disease, and by general good health.

In corroboration of these propositions, Mr. Hambleton calls attention to the invariable association of phthisis with confinement. In a convent in Paris all the nuns became phthisical, while the portress, who was not subjected to the same regulations, and went out daily for supplies, remained in good health. Perfectly healthy men, brought up in the country, have gone into towns, and engaged in occupations that either necessitated long hours, in close rooms, in cramped positions, or the inhalations of particles of dust, and after a time have become ill with all the symptoms of consumption. This disease has thus been shown to be produced by two distinct sets of conditions: in the one we have those that reduce the breathing capacity by habitual disease of the lungs; and in the other, those that reduce the breathing capacity either by habitual compression of the chest or by injury to the lungs.

The prevention of consumption is, according to this theory, a very simple one, — to place all persons under conditions of habitation, clothing, education, and habits that tend individually and collectively to develop the lungs, and that prevent or obviate compression of the chest or injury to the lungs. These views of Mr. Hambleton are very fully set forth in a brochure entitled 'What is consumption?' and in a paper read at a meeting of the British association, on the scientific prevention of consumption.

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SOME months ago a number of persons went from Glasgow to Loch Fyne to see a large blasting operation in which six and one-half tons of gunpowder were exploded. A short time after the explosion many of the observers became faint, six of the number died almost immediately, one died shortly after, and five others were very ill but recovered. The cause of death is believed to have been the carbonic oxide generated from the gunpowder. It is estimated that the amount must have been 468 pounds, — a quantity sufficient to occupy 6,333 cubic feet of air space, or to vitiate for respiratory purposes a space one hundred times as great. There were also generated 3,575 pounds of carbonic anhydride; so that, in all, there were 1,266,000 cubic feet of air rendered irrespirable.

— Dr. D. F. Lincoln, in a letter to the *Boston medical and surgical journal*, narrates a personal experience in Savannah with a kerosene-stove. In a room containing 1,100 cubic feet of air space, he introduced a kerosene-stove for heating-purposes, being able to raise the temperature by its means eighteen degrees. Although there was some odor, nevertheless he did not experience any personal discomfort. One evening he noticed that the reading-lamp was dim, the flame having shrunk to half its size. When he carried it into the entry, it burned brightly. He subsequently tested the air with Walpert's air-testing apparatus, and found the amount of carbonic acid had reached sixty-seven parts per thousand, the normal amount being three or four parts. Each of the two burners in the stove was four inches in length, and generated as much carbonic acid as eight or ten common lamps. In a well-built house with tight doors the effect might be doubled.

— In the *British medical journal* are reported two cases of chronic cocaine-poisoning. The patients were a man and wife who had formerly been addicted to opium, and who had taken cocaine as an antidote. They commenced with small doses, but finally took daily 2.5 grams hypodermically. The prominent symptoms were incoherence of ideas and optical delusions. They saw on their hands, on the beds and walls, small spots and worms of all forms. Complete recovery followed the discontinuance of the cocaine.

— The figures representing the mortality of a great city like London for a single week are appalling. During the week ending Jan. 1, 1887, there were registered in that city 1,899 deaths, of which 114 were from measles, 25 from scarlet-fever, 27 from whooping-cough, and 17 from typhoid-fever: 74 deaths were caused by violence, 66 being the result of negligence or accident, and 7 being suicides.

— A physician of Cairo has been treating an opium habitué with cocaine, the result being that a cocaine habit was soon established, the patient so enjoying the sensation produced by the drug as to be led to use it on the slightest provocation. At one time the amount injected hypodermically was one and a half grams daily. As a result, he suffered from a condition similar to delirium tremens, became greatly agitated, and had hallucinations. He fired a pistol at imaginary objects, attacked his servant, and was at last put into a hospital. He recovered subsequently, injections of morphine being the treatment adopted.

## A SYSTEM OF ORTHOGRAPHY FOR NATIVE NAMES OF PLACES.

THE Royal geographical society of London, and the Société de géographie of Paris, have each adopted a system of geographical orthography which is intended to put an end to the existing confusion in the mode of spelling in maps and books. We fully agree with the first rule set forth by the Royal society, — "No change will be made in the orthography of foreign names in countries which use Roman letters: Thus, Spanish, Portuguese, Dutch, etc., names will be spelt as by the respective nations." The second rule is, "Neither will any change be made in the spelling of such names in languages which are not written in Roman characters as have become by long usage familiar to English readers : thus, Calcutta, Cutch, Celebes, Mecca, etc., will be retained in their present form." Though this rule may give rise to some doubt as to what names have become by long usage familiar, it may be accepted. We should prefer to retain anglicized foreign names, e.g., Munich for München, Milan for Milano, Normandy for Normandie, instead of introducing the original form, as the first rule demands. The new system does not provide for the spelling of names in languages written in foreign characters. Of course, German and Danish must be classed among the languages to which the first rule refers. But it is doubtful how Russian and Polish names shall be spelled. In the Polish language the Roman, in the Russian the Cyrillic, alphabet is used, and yet the sounds of the languages are very similar. It would be inconsistent to apply to the one the first rule, while the other is spelled merely according to the sound. It would have been desirable that the society should have expressed its opinion on this point more precisely. The phonetic rules do not decide whether it is correct to spell Kasimov, Kasimof, or Kassimov, nor will we be able to decide whether it be correct to write Trnova, Ternava, Ternova, or Tirnova.

The third rule is, "The true sound of the word as locally pronounced will be taken as the basis of the spelling;" and the fourth, "An approximation, however, to the sound, is alone aimed at. A system which would attempt to represent the more delicate inflections of sound and accent would be so complicated as only to defeat itself." Both these rules are good, as far as they go. Any linguistic alphabet would be too complicated for the general reader, and therefore the idea of applying it must be at once rejected. The alphabet upon which the society has decided follows the principle that vowels are pronounced as in Italian, and consonants as in English. This does away with the *ee* for the sound *i* in 'ravine,' and with the *oo* for the *u* in 'flute.' The rule that vowels are shortened in sound by doubling the following consonant is not good, as repetitions of consonants occur in many languages, and short vowels are of more frequent occurrence than long ones. Therefore it is better to mark the long ones. The French alphabet is in many respects better than the English. This is particularly true in regard to the introduction of the circumflex for marking the length of a vowel, and of the apostrophe for indicating exploded sounds. The German *ö* and *ü*, which are not in the English alphabet, are expressed by the letters *oe* and *ü*. The use of *dh* for the soft *th* (as in 'these') is another improvement.

Both systems, though materially improving the system of orthography of geographical names, are open to criticism. Whoever has any experience in reducing languages to writing, and has compared his notes with those of other students, or even the notes written before any knowledge of the sound and structure of the language was obtained, with later ones, will acknowledge that the sound as perceived by a traveller is in no way binding. The individuality and nationality of the author give the sound a peculiar character which not at all corresponds to the word as pronounced by the natives. In Central Africa, for instance, we find *r* and *l* or *j* and *ch* constantly interchanging, according to the nationality of the explorer. The rules adopted by the societies named can only help the explorer who is not at all acquainted with linguistics — which every explorer ought to be — to write down the names in an intelligible form. They are in no way sufficient for determining the proper spelling. This ought to be done by linguists, and the results of their studies laid down in a gazetteer. It is impossible to decide by a rule whether it is correct to write Uganda or Waganda ; Urua, Warua, or Kerua, though the linguist will know that the first is the name of the country, the second that of the people, and the last the adjective form. On the English admiralty charts we find numerous mistakes. Native names are mistaken for English, and misspelled so as to make the meaning intelligible. In Davis Strait we find the name 'New Gummi Luck.' The correct name is 'Nugumiut,' and means 'the inhabitants of the cape.' On the north-west coast of America we find the place 'Bella Bella.' Though this name has become that of a settlement, its origin dates back to a misunderstanding. The channel on which it is situated has the name 'Milbank Sound.' The natives of that district cannot pronounce this word, and say 'Bilbal,' which is transformed into 'Bella Bella' by the English traders and seamen. Similar mistakes occur everywhere. For these reasons it is impossible to

lay down a few rules that would enable us to spell any geographical name correctly. The system adopted by the Geographical society, however, is a decided improvement, inasmuch as every letter has only one meaning, and there is no room for doubt in the pronunciation of a written name. Therefore *Science* will adopt this system, with the improvements made by the French geographical society.

The pronunciation of letters will be as follows: —

*a* = *a* in 'father.'
*e* = *e* in 'there.'
*i* = *ee* in 'feel.'
*o* = *o* in 'mote.'
*u* = *oo* in 'fool.'
*ö* = *e* in 'her.'
*ü* = *ü* in German: München.
*ai* = *i* in 'ice.'
*au* = *ow* in 'how.'
*b, d, f, j, k, l, m, n, p, r, s, th, t, v, w, z, ch*, as in English.
*g* = *g* in 'garden.'
*h* is always pronounced, except in *th, kh*, and *gh*.
*kh* = the oriental guttural.
*gh* = another oriental guttural.
*y* = *y* in 'yard.'

Vowels are lengthened by a circumflex. Letters are only doubled when there is a distinct repetition of the single sound.

## PSYCHIC BLINDNESS.

In this book Dr. Wilbrand has put together a most valuable and interesting series of facts and discussions concerning certain curious and important morbid phenomena. The appearance of such a book furnishes an excellent illustration of the great value and importance of the new view of brain-physiology. This view really takes its origin in the discovery of the electric irritability of the cortex by Fritsch and Hitzig in 1870. Their results at once led to more exact and adequate conceptions of the nature of brain-centres; and, when the pathologist and alienist came to study the forms of brain-lesion and impairment of function with the conceptions derived originally from physiological experiments, the advance step was a great one. And finally psychology must already acknowledge a debt to pathology probably greater than it owes to any other of the many sciences with which it is so intimately associated. Our mental structure is so extremely intricate and so wonderfully formed, that we must use all possible devices to simplify the problems it offers to the psychologist: hence the study of the less complex minds of the lower animals, the observation of the developing faculties of children, and the records of the primitive culture of man, derive their importance. Pathology performs an even more delicate service. It takes away or incapacitates more or less of this complex machinery, and shows in what way the working of the apparatus is thereby affected. Just as we never really appreciate the value of an object until we are without it, so the importance of certain brain-cells to mental sanity is not realized until disease renders them useless.

*Die Seelenblindheit als Herderscheinung und ihre Beziehungen zur Homonymen Hemianopsie zur Alexie und Agraphie.* Von Dr. HERRMANN WILBRAND, Wiesbaden.

Some years ago Professor Munk described the condition of dogs from whose brains a certain cortical area had been removed, and gave it the name of 'psychic blindness' (*Seelenblindheit*). A dog in this condition can see, for he avoids all obstacles as well as ever, but what he sees has lost all meaning for him. If, for example, the dog was accustomed to jump over a rod when it was held before him, he no longer recognizes this signal: his whole psychic life is duller, and, in particular, the world of sight has lost all significance. This is now only one of a large series of phenomena which show that there is one centre in which an object is seen and another centre in which it is perceived, or, better, apperceived. Disease may injure one and leave the other intact. Dr. Wilbrand records two very remarkable cases of this nature, in both of which the patient retained normal intelligence, and accurately described the symptoms. The first is reported by Charcot, and relates to a highly intelligent merchant well versed in several languages, and reading the classics fluently. Up to the time of his attack, he could repeat the whole of the first book of the Iliad, beginning at any point. He had from his boyhood a most remarkable memory, which was almost exclusively a visual one. He could read pages of his favorite authors from the visualized picture of the page which he carried in his mind. If an incident of his many travels was spoken of, the whole scene appeared before him, vivid and complete in every detail. He was an expert draughtsman, and often sketched interesting portions of the landscape on his travels. As a consequence of serious business troubles, his health gave way: he became nervous and irritable, and the peculiar visual symptoms appeared. He found that the sight of the buildings and the scenes of his daily walks seemed strange. If asked to picture a certain place to himself, he was unable to do so. The attempt to draw a church-spire resulted in a rude childish scrawl. He could not remember the faces of his wife and children, and even failed

to recognize his own image in a glass. Even the familiar scenes of his childhood had faded from his memory. In order to understand what he read, he had to cultivate an auditory memory, and read every thing aloud. He no longer dreamt of seeing, but only of hearing. Deprived of the mental imagery which sight furnished, and which in his case was a more serious loss than to persons with less brilliant visualizing powers, his mental life became sluggish and his moods melancholic and sad. The second case from Dr. Wilbrand's practice is no less remarkable, and presents certain peculiar characteristics. Chief among these is a falling-out of the left half of the visual field; that is, the patient could not see with the outer portion of the left retina nor with the inner portion of the right retina (homonymous hemianopsia). This symptom indicates a unilateral cortical lesion.

Dr. Wilbrand analyzes the process of vision one step further. He gives reasons for believing, that, besides the centre for the reception of the visual impression and that for its apperception, there is a third group of cells, whose function it is to store up visual memories, which form the visual memory-area (*Erinnerungsfeld*). If the retina or the optic nerve is destroyed, the result is blindness in the usual sense of the word. But the optical memory remains intact; the visual phantasy is still active; sight hallucinations and dreams may occur, and so on. If the apperceptive centre of one hemisphere is involved, then homonymous hemianopsia of the opposite half of the visual field occurs, and there is psychic blindness in one-half of the brain. If both apperceptive centres are involved, sight hallucinations are impossible; but the visual memory is not directly affected, and sight dreams may occur. If the memory-area is diseased, objects are no longer recognized as familiar: all seems strange and new. The fantasy is dulled: there are no visual imageries or dreams.

Many of these suppositions receive a striking confirmation from the observation of those born blind and restored to sight by successful operations. Such persons are just like infants as regards sight, except that they learn to see much more quickly. Their higher sight-centres must be developed, and in this process one can distinguish the three stages above marked out. Such persons recognize at once after the operation that they have a new sensation, — they see. But the object before them is not apperceived: it is not recognized as the same object they have been touching all along. They soon learn the meaning of their visual impressions, though they constantly call on the sense of touch to prevent deception; but they often fail for some time to remember what they have seen, and rarely dream of seeing things for many months: in other words, their apperceptive and visual memory-centres are developing. The chapter devoted to this topic records other interesting points in these cases, and can be recommended as an admirable account of the subject.

The rest of the book is devoted to the explanation of the detailed pathological symptoms and the discussion of their relation to the centres of language, both written and oral. This more technical part of the subject does not readily admit of a brief exposition. Suffice it to say that Dr. Wilbrand has rendered an important service to several branches of science by this convenient and thorough account of a most important topic. Some of his theories are doubtless to be modified and perhaps rejected by future research, but the spirit and point of view of his exposition is in the right direction. As was said at first, it shows the vast explanatory power of the modern theories of brain-physiology.

J. J.

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## *BASCOM'S SOCIOLOGY.*

HERBERT SPENCER, who has done more than any other one man of this generation to popularize the study of social science, points out very forcibly, in his book on the 'Study of sociology,' the difficulties which beset the student of social phenomena and conditions. He shows us there that something is true of sociology that holds good in no other science; namely, the facts to be observed and generalized by the student are exhibited by an aggregate of which the student himself forms a part. His functions and life as a citizen, therefore, determine in a large measure his stand-point and methods as an investigator. It is on this account essential, in estimating the value of sociological researches, that we know something about the personality of the observer. In the case of President Bascom we are peculiarly fortunate in this respect. His long and honorable career as a teacher and professor both in the east and in the west, as well as his numerous writings in the fields of philosophy, literature, and religion, afford us ample information as to the methods and postulates of his thought.

In fact, this newest book from his pen is best understood when read in connection with his previous books on psychology, ethics, and the philosophy of religion. The tone and the style of treatment are the same in all.

In his preface to the present work, President Bascom expressly says that his aim has been to cover a large field suggestively, rather than a nar-

*Sociology.* By JOHN BASCOM. New York, Putnam. 12°.

row field exhaustively. He believes that in some cases this method is of more practical value than its contrary. Sociology he defines as "a discussion of the conditions and laws of combination and growth in society." In the following sentence he adds that this definition includes change which is retrogressive as well as that which is progressive. It is plain that any good definition of sociology must include retrogressive change, inasmuch as a considerable school of thinkers assert that the world and society are becoming worse all the time. Perhaps the substitution of the word 'development' or 'evolution' for 'growth' in the above definition would have obviated the necessity for this explanation, because it is well understood nowadays that evolution includes progress from good to bad as well as from bad to good.

The author's various chapters on custom, government, economics, religion, ethics, and so on, are of much interest, although very sketchy in character. His style is good, and enlivened with numerous illustrations of the argument. One of the first questions to be asked about a book of this sort is, What position does the author take in respect to the pressing questions of socialism and the limit of governmental functions? We can best answer this in President Bascom's own words. "The office of the state," he says (p. 45), "is not simply to recognize a primitive equality of rights, and to grant these rights the protection we term justice. Such a course will soon issue in extreme equalities. It has the far more difficult duty of encouraging and aiding unimpeded activity in every class, and at the same time renewing its conditions in each class. Each citizen is, under general principles, to be put back as speedily as possible on his feet when he has lost them. The race is to be renewed, morning, noon, and night, on equal terms. The state must then be benevolent as well as just. While it takes from no man what he has, it must not allow any man such an exercise of his powers as will ultimately swallow up the powers of other men. . . . The state must put positive limits on powers, when, by natural force and the conferred energy of society, they are ready to break the bounds of prosperous and beneficent competition."

There is much in President Bascom's chapters on ethics and religion that is suggestive, especially his comprehensive use of the word 'morality,' and his illustrations of the degenerating process as to particular parts of a religion which usually accompany *its* development. The publishers would have greatly increased the value of the book had they provided it with an index. Unindexed books are a relic of barbarism.

## JUKES-BROWNE'S HISTORICAL GEOLOGY.

THIS volume completes the 'Student's handbook of geology;' the first part, on physical geology, having appeared in 1884. The author states his intention as being "to give as full an account of the rocks of Great Britain and Ireland as space would permit, supplementing this with only so much of continental geology as is necessary to fill up the gaps in the British records and to complete the outline of geological history." After a brief but excellent introduction on the laws and applications of paleontology, the book proceeds to a review of the formations, giving a chapter to each system. An account of every separate area in the British islands is given under each formation, with numerous sections and illustrations of characteristic fossils, and each chapter closes with a statement of what is known or inferred of the physical geography of the period. Some departures from the divisions of geological time usually employed in America and on the continent of Europe will be noticed. Thus the Cambrian is regarded as a distinct 'system,' as is the lower Silurian, for which Lapworth's term 'Ordovician' is taken. It is interesting to notice that Mr. Walcott's studies lately published lead him to a similar result for this country. More novel is the division of the tertiary rocks into two systems, for which Mr. Jukes-Browne proposes the terms 'Hantonian' (including the eocene and oligocene) and 'Icenian' (including the miocene, pliocene, and pleistocene). The quaternary is thus given an entirely subordinate position. *

The science of geology includes such a great number of distinct subjects that no one man can master them all, and for this reason the text-book of the science that shall be equally satisfactory in all departments has yet to be written. Probably it can only be written by the co-operation of many specialists. The first part of Mr. Jukes-Browne's handbook, that on physical geology, is excellent, and will be found most useful to American students; but the volume before us cannot be of nearly such general value, as, from its plan, it is adapted only to Great Britain. But even there we think the comparatively minute study of British formations, to the exclusion of the rest of the world, is a mistake. It is true, that, in whatever district the English student may be, he will find a clew to its geological structure in this book; but this advantage is more than counterbalanced by the loss of a general view of the earth's developmental history. Such a method must give the beginner very disproportionate views, and result in the loss of all 'perspective.' American

* *The student's handbook of historical geology.* By A. J. JUKES-BROWNE. New York, Scribner & Welford. 8°.

geology, which throws so much new light upon the subject, is almost completely ignored.

Mr. Jukes-Browne is not a biologist, and his remarks on the structure and affinities of extinct organisms are not always happy. The anatomist will hardly agree with such statements as the following (p. 437): "Of the mammals, Coryphodon and Lophiodon resembled the recent tapir; Palaeotherium and Paloplotherium were animals from which both the rhinoceros and the horse seem to have descended; Hyracotherium was a small animal combining characters now found in the peccary and the hyrax or Syrian coney." On the same page the snout of an alligator is inverted and called the lower jaw. Our author seems not to have heard of the great paleontological discoveries of the last twenty years on this side of the Atlantic, as he mentions only the mastodon, of which a wretched figure is given, and the mammoth.

It would, however, be very unfair to leave the impression that this is a carelessly written book. It is nothing of the sort, but, on the contrary, has been compiled with painstaking accuracy, and in many respects has been admirably done. While it cannot be recommended as a text-book in this country, it will prove of great service to investigators as a book of reference and comparison, containing much valuable information in a small space.

## *BERGHAUS'S ATLAS OF PHYSICAL GEOGRAPHY.*

THE geographical institute of Justus Perthes in Gotha is publishing a new edition of Berghaus's 'Atlas of physical geography' ('Physikalischer Atlas'). Though the editor retains the name of the old edition of 1838–48 and of 1852, this is a totally new work, not one of the old maps being used in the new edition. The most eminent authorities in the different branches of physical geography contribute to this work, each department being intrusted to a specialist. Berghaus himself is the author of the hydrographical part, and to him is due the excellent execution of the work, which comes up to the standard we are used to apply to works published by Justus Perthes. J. Hann edits the meteorology; G. Neumayer, the part on terrestrial magnetism; von Zittel, geology; O. Drude, geography of plants; G. Hartlaub and W. Marshall, the distribution of animals; and G. Gerland, the ethnological part. The names of these scientists warrant that the material will be reliable, and in every respect be kept up to date. The maps are copperplate prints, and bear the date of publication. This way of reproduction will enable the publisher to have any desirable corrections made, so that we may be sure to see the maps always corresponding to the latest state of our knowledge. The economical use of space on the single sheets is really admirable. Map 16, for instance, contains the drainage-areas of the oceans, which are represented in Lambert's equivalent projection. These maps show the limits of ice-drifts, currents, deltas, and the navigable extent of rivers. On the same sheet we find eleven detail-maps showing the different kinds of bifurcations, and two diagrams showing the extent of land in different latitudes.

The general principle of the atlas is, first, to give maps of the earth and of continents, showing the distribution of physical phenomena; and then detail-maps, which are particularly illustrative of it. On the map showing the annual rainfall (No. 37) we may observe the influence of elevation and wind on detail-maps of Jamaica, Mauritius, and New Zealand. On the map of the German Ocean (No. 23) we find the various types of coasts, — the rias of the north coast of Spain, the downs of France and Germany, and the fjords of Norway. Diagrams show the temperatures of the ocean. This atlas is an indispensable work for the student of physical geography. Its systematically selected contents and excellent execution make it a worthy companion of Stieler's 'Hand-atlas' and Spruner-Mencke's 'Historical atlas.' As the editor does not give any preference to the physical geography of Europe, it is as valuable for the American student as for the European.

## *A CENTURY OF ELECTRICITY.*

THOSE whose curiosity is excited by the presence on every street-corner of an electric light, and in every doctor's office of a telephone, in every railway-station of a clicking telegraph instrument, and yet have been unable to find time or opportunities for understanding how these things have been brought into existence, will find in Professor Mendenhall's little book, 'A century of electricity,' a trusty guide which will lead them by easy steps from the beginnings of a science of electricity towards the end of the eighteenth century, through the discoveries of Galvani, Volta, Oersted, Faraday, and others, to the present time. Professor Mendenhall's success as a writer is too well known to need especial praise in this place. The author has endeavored to sketch the growth of the science of electricity and its principal applications. The book is not a history of the science, nor is it a scientific treatise, and the use of technical language has been avoided as far as

*A century of electricity.* By T. C. MENDENHALL. Boston, Houghton, 1887. 16°.

possible. The effort of the author, and it has been a successful one, was to enable the intelligent reader, unfamiliar with the nomenclature of the science, to understand the more important phases of its development, and to give him such a knowledge of its fundamental principles as will enable him to comprehend the meaning of what he sees in electrical devices with which he almost daily comes in contact. The book opens with an account of some experiments in submarine signalling, as they might well be called, made in April, 1749, by Benjamin Franklin, which pictures him as sporting with his pet sparks at a picnic-party on the banks of the *Skuylkil*; and frequently through the pages one discovers little sketches of the personalities of the investigators, which add much to the interest of the reader. We can recommend the book most highly to all those for whom it is intended, and commend the publishers for the way in which it has been brought out, and for the excellence of the illustrations, which present so few of the hackneyed cuts disfiguring the ordinary manual.

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THE third part of 'A new English dictionary on historical principles' (Oxford, Clarendon press; New York, Macmillan, 1887) has been received. We reviewed at length the first two parts in *Science* of June 18, 1886. Part iii. deals with 8,765 words, from 'batter' to 'boz.' It is a characteristic of the letter B that it contains a comparatively small number of words derived from Latin or Greek, and a preponderating proportion of words of Teutonic origin: hence this section includes many of the oldest words of the language. The B-words are full of problems which have baffled the efforts of all investigators. Every one of these has received a fresh and independent investigation, in which assistance has been rendered by some of the first living philologists; and the result has been the discovery of new facts, or the elimination of old errors, in regard to many words. In addition to the words of Old English and Old French origin, this part contains an extraordinary number of words of unknown or uncertain derivation. Many of these have no kin in other languages, but stand quite alone in English, and, it cannot be doubted, are more or less recent creations of English itself. B contains many illustrations of the fact that has of late years powerfully impressed itself upon philological students, that the creative period of language, the epoch of roots, has never come to an end. The origin of language is not to be sought merely in a far-off Indo-European antiquity, or in a still earlier pre-Aryan yore-time: it is still in perennial process around us. A literary language, with its more accessible store of words already in use and sufficient for all ordinary requirements, its more permanent memories and traditions, its constant appeals to an authoritative precedent, is hostile to word-creation. Such is not the case with language in its natural state, where words are estimated simply as they serve their purpose of communicating the thought or feeling of the moment. The unwritten dialects, and to some extent even slang and colloquial speech, approach in character to language in its natural state, aiming only to be expressive, and treating memory and precedent as ministers, not as masters. Some words so coined pass at length from colloquial into literary use, and are registered in the dictionary as new words, the origin of which is searched for as vainly in the word-hoard of Old English speech, or even the fullest vocabulary of Indo-European roots, as in a school-manual of Latin and Greek roots and affixes.

— Bulletin No. 31 of the U. S. geological survey, by S. H. Scudder, is a systematic review of our present knowledge of fossil insects, including myriapods and spiders. It is essentially a translation, for the benefit of English readers, of the text furnished by the author to Dr. Zittel for his 'Handbuch der Paleontologie.' The German text, however, is accompanied by more than two hundred illustrations. M. Barrois is also publishing a French version. Each section of the work is accompanied by a complete bibliography, which shows us at a glance how recently this department of paleontology has been developed, very few of the titles dating back of 1850, and how extensive and varied the author's own contributions have been. The concise descriptions of the classes, orders, and families, are accompanied by brief notes on the fossil genera and species, with the locality and geological horizon in many cases; while the stratigraphic distribution and range of each order are shown by tables giving the number of species found in the rocks of each age. No fewer than twenty-six hundred species of true insects have been found fossil up to the present time. The great majority of these, as well as of myriapods and arachnids, are from the middle tertiary. This great irregularity in the chronological distribution of the fossil forms, which is, of course, due largely to the character of the deposits, is a plain indication that important insect faunas still remain to be discovered. Thus, of the fossil spiders, thirty-one forms are known from the paleozoic strata, one from the mesozoic, and two hundred and eighty-five from the tertiary, the great majority of the tertiary forms having been found in the amber deposits of Prussia.

# SCIENCE.

FRIDAY, MAY 6, 1887.

## COMMENT AND CRITICISM.

DURING THE CENTENNIAL YEAR some of our leading geologists in the United States and Canada conceived the happy thought of calling an international congress of geologists for the purpose of agreeing upon such important though subsidiary matters as the colors by means of which the different geological formations should be expressed, the terms that should be applied respectively to these formations, and also upon the far more important problem of the limits and values of these different formations. The first session of this congress was held in Paris in 1878, the second session in Bologna in 1881, and the third session in Berlin in 1884. The third session found the preliminary difficulties so far cleared away that some definite and tangible results could be attained; and it was decided to make an attempt to embody these provisional results in some work which should include as many as possible of the difficulties to be encountered by any plan of unification, and at the same time be one with which the largest possible number of geologists were familiar. This additional precaution was adopted in order that whatever steps might be taken should be well advised. This was the reason for the selection of the continent of Europe as an area upon which to test the proposed classification and coloration schemes. Not only are there more geologists and larger geological collections in Europe, but the fact that each of the countries of Europe supports its own geological survey, and employs its own methods independently of all the rest, has for its consequences that there are more differences of opinion among geologists on the continent of Europe, both in important matters and in matters of detail, than in all the rest of the world put together. If, then, a compromise could be effected which would satisfy the conflicting notions of European geologists, it was reasonably sure that a system of unification for the whole world could be arranged. It is true that there are some questions to be settled upon which European geology can shed but little light, but they are not numerous, and they can certainly be adapted to the rest of the general plan when that has been decided upon.



The congress restricted to each of the 'large countries' of Europe — to wit, France, Spain, Austro-Hungary, Russia, Scandinavia, Germany, and Great Britain — the right to become a *subscriber* to the proposed geological map of Europe, to be issued under the direction of a specially appointed committee of the congress. The number of copies of the map to which each subscriber is entitled is one hundred, and the price one hundred francs per copy. The American committee of the congress, feeling that the questions involved were of universal and not of merely European interest, sent a request to the committee of direction, asking that the United States be included in the list of subscribers. The response of the executive committee to this request was favorable. The object of the American committee is to get the names of one hundred institutions or individuals as subscribers to the map, so that the United States can occupy the same position among the *grands états*, through these private subscriptions, that Germany, France, etc., occupy by reason of the direct subscription of their governments. For the purpose above indicated, a circular was mailed by the American committee to one hundred and fifty institutions of learning and original research six months ago. It was then thought that the one hundred copies would be entirely exhausted by such institutions at once. As this has not proved to be the case (largely owing to the time at which the circulars were sent out), the American committee, at its Philadelphia meeting last December, decided to send out another, and, in addition, to invite a few scientific men to take advantage of the same privilege. Up to the present date, but fifty subscribers have sent in their names. In case of failure to secure one hundred subscribers, the committee must either pay the cost of this number of copies ($2,000) itself, or ask the comité directeur to withdraw the United States from its list of subscribers.

TWO HUMAN SKELETONS have been discovered in the lower quaternary deposits, in a cave on the banks of the Orneau, in the commune of Spy,

province of Namur. The remains have been examined by Professor Fraipont, who discusses the subject in the Bulletin of the Royal Belgian academy. As we have not seen a full account of the finding of the remains, we confine ourselves to giving the report in *Nature* by A. H. Keane, who says that they were found in undisturbed strata, together with remains of Rhinoceros tichorhinus, Elephas primigenius, Ursus spelaeus, Hyaena spelaea, Felis spelaea, the horse, wolf, sheep, and other now extinct and surviving pleistocene animals. This fauna, and the character of the coarse flints occurring in the same strata, would seem to indicate that these men must have lived during the early period of the mammoth, and long before the beginning of the reindeer age.

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"M. Fraipont's study of these remains," says *Nature*, "makes it thus abundantly evident that they belong to the Neanderthal type. The two skulls even serve as a sort of missing link between the Neanderthal and the others usually referred to the same race. This race, whose presence in Europe during the early mammoth age has now been clearly traced from Staengenaes in Scandinavia to Olmo in Italy, seems in a way to have been resuscitated by the fortunate discovery in the limestone cave on the banks of the Orneau. Their dry bones again assume flesh and blood, and science is enabled confidently to describe the men of Spy as a short but far from 'feeble folk,' thick-set, robust, walking knees foremost, and with a figure somewhat analogous to that of the modern Lapps. Their broad shoulders supported a long, narrow, and depressed head (different, therefore, from that of the true Papuan, which is long, narrow, and high), with very prominent superciliary arches, enormous orbits, low and retreating brow, high and massive cheek-bones, and receding chin."

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It will be remembered that B. Dawkins's critical researches on human remains of the lower quaternary resulted in the discovery of the fact that their exact age cannot be proved, and that they are probably of far younger origin. Besides this, we call to mind Virchow's researches on the famous Neanderthal man, whom he found to have been very old and crippled, probably unable to support himself, and therefore not a type of his race. For these reasons we defer a fuller report until the facts shall be better known. The existence of man in the lower quaternary cannot be doubted, as numerous stone implements have been found in deposits of that period. The discovery of human skeletons belonging to this age would be a very important addition to our knowledge.

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THE RE-ISSUING of the famous 'Vestiges of the natural history of creation' in Mr. Morley's universal library, makes one realize the enormous step that modern biology has taken. This work, it is hardly necessary to say, was published anonymously, but the authorship was afterwards acknowledged by Robert Chambers. It is a popular statement of evolution fifteen years before the 'Origin of species,' and is sometimes spoken of as a very remarkable anticipation of Darwinism. But it failed to show any proof of a motive power, and does little to lessen the originality of Darwin's work. Chambers is very deeply concerned in showing that his views are not opposed to religion, and devotes much space in this cause. Yet this book was received with a storm of denunciation which it is difficult now to appreciate. This the author bore very philosophically; for, as he explained, his design in not putting his name to the book was "not only to be personally removed from all praise or censure which it might evoke, but to write no more on the subject."

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THE LATEST COPY of the 'Pilot chart,' a monthly publication for the guidance of mariners, shows that there are to-day eleven dangerous wrecks right in the path of vessels in the coasting trade along the eastern coast of the United States. In any other country on the civilized globe a man-of-war or a government vessel of some description would have been despatched to destroy these wrecks as soon as reported. There is nothing, not even an iceberg, more dangerous to navigation than a water-logged 'derelict.' Yet up to the present time there is no one in the United States with the necessary authority to order a vessel out to remove these dangers from the pathway of our merchant marine. Time after time the attention of congress has been called to this subject, and the officers in charge of the 'Pilot chart' have repeatedly urged that a small appropriation be made to enable the navy to maintain a small ship for the purpose of removing floating dangers as soon as they are reported. But there is no one so directly interested as to spend time and money in hanging about the doors of congress to see that this recommendation is considered. In

consequence, year follows year, and the very sensible recommendation is unheeded. It is estimated by a naval officer who has given a great deal of attention to this subject that the actual annual loss to the merchant marine of the United States from striking upon these unmarked obstructions is equal to at least ten per cent of the losses from all other causes combined. The cost of building and maintaining the necessary vessel to remove these obstructions would be more than saved in the first year by the prevention of losses to coasting-vessels and transatlantic steamers which are jeopardized by the failure of the government to do its duty in this respect.

## EXPLOSIONS IN COAL-MINES.

'A REPORT by W. N. and J. B. Atkinson, inspectors of coal-mines for the north of England,' recently published, is a very valuable contribution to our knowledge of an intensely practical subject, viz., the causes of explosions in coal-mines; and it is simply wonderful, considering how much this question has been investigated during the last hundred years, that some of the most important facts should not have been correctly apprehended or fully appreciated until this late day.

The nature of one cause of explosions, fire-damp or coal-gas, was demonstrated long ago,
and guarded against by the invention of the
But that there must be some other
ually potent has long been evi-
ful minds, from the fact, that,
-lamp is in general use, explosions
singly frequent and fatal. Thus
s for the years 1850 to 1885 show,
Kingdom alone, an annual average
tal explosions, the annual loss of
me period averaging two hundred
ven.

of the Messrs. Atkinson shows that
coal-mines is now the chief explosive
the explosions usually resembling those
e flouring-mills of Minnesota. This is
y or foregone conclusion on the part of
rs, but it has a broad basis of experience
y the direct and careful investigation of
mportant explosions. The discussion is
d thoroughly scientific, for not only is
tatement abundantly fortified with facts,
is made very clear in every case that no
view is tenable.

all the collieries of the north of England the
seams lie at a considerable depth below the
ace, with which they are connected by at
t two shafts, — a *downcast* for the admission of fresh air, and an *upcast* for the escape of the foul air from the workings. The circulation is usually maintained by a furnace at the bottom of the upcast shaft. The fresh air passes from the downcast by straight roads, from which lateral escape or leakage is prevented, to the working faces, and thence returns by other roads and through the abandoned parts of the colliery, where the coal has been removed and the roof allowed to fall in, to the upcast. The intake airways are usually the oldest parts of the workings, and are also the main avenues for hauling out the coal and for the ingress and egress of men and horses; while the return airways are rarely used for any other purpose than the passage of the foul air.

Fire-damp or light carburetted hydrogen exists in all the coal of this district, and issues constantly from the freshly exposed surfaces in the working places; but the ventilation is usually so efficient, that the gas cannot be detected even along the return airways, and it is very rarely observed on the main intake roads traversed by large volumes of fresh air, their surfaces having long exhausted themselves of gas. Naked lights are often used in the outer portions of the intake roads, and locked safety-lamps, as a rule, in all other parts of the colliery. Observations are cited which show, that, while one volume of fire-damp to fifteen volumes of air is required to make an explosive mixture, in the first half-mile of the intake roads the proportion cannot exceed one volume of fire-damp in fifteen hundred volumes of air. And yet it is exactly in this part of the colliery that the explosions are most frequent and violent.

The coal is largely of a tender or dusty nature; and, although the shafts are usually wet, the working planes are, for the most part, quite dry, and the air especially, although moistened by its passage down the wet shaft, becomes very dry through the rise of temperature due to the fact that the temperature of the ground increases downwards.

The return airways, where the fire-damp is most abundant, are usually quite free from dust, and at the working faces the dust is not often a serious evil. But the principal accumulations of dust are found along the roads through which the coal is hauled, i.e., the intake airways. It is especially abundant where the coal is hauled by engine-power, or at a high rate of speed. The dust is shaken and blown out of the cars by their rapid motion against strong currents of air, and flies as a cloud along the top of the train. The heavier particles fall to the bottom of the roadway, and the lighter particles form a deposit on them, which

parts as well as on the floor. This fine dust is not only found on horizontal surfaces, but it exhibits the property of sticking to timber, stone, and coal, something like soot hanging in a chimney, being sometimes from one to two inches thick on vertical and overhanging surfaces. In dusty mines it is often necessary to remove the dust on the floor of the roadway to prevent the tracks from becoming blocked; but the upper dust is not interfered with. Only one pound of dust to one hundred and sixty cubic feet of air is necessary in order to form an inflammable mixture, and this proportion is often largely exceeded on dusty roads.

Coal-dust in mines is often referred to as constantly present in the air. This is not so, except to a limited extent. The velocity of the air is rarely sufficient to carry dust any considerable distance. When dust is largely present in the air, it is due to some disturbing cause other than the ordinary movement of the air. The rapid passage of cars against the air-current raises a cloud of dust from them; the passage of men and horses stirs up the bottom dust; the hewer at the working face raises about him a thin cloud of dust; the concussion of a blast, or wave of air caused by a heavy fall of stone, fills the air with dust; but in the absence of some such cause the dust is quiescent, and after its disturbance by any cause it soon settles down again. The fine, soot-like, upper dust is, however, extremely inflammable, even when not disturbed; and after explosions the greatest amount of violence is observed on those roads likely, before the explosion, to contain the most of this kind of dust. After explosions, the dust thrown into the air and ignited is found to be very generally coked.

Not only has there been heretofore a general misconception as to the nature of the explosive substance, but also as to the actual cause of death of the victims. This may occur from *flame, force of the explosion, falls of stone and timber, suffocation by dust, or after-damp;* but the evidence goes to show that the immediate cause of death, in almost all cases, is after-damp, i.e., the gases resulting from the explosion. After-damp produced by the explosion of ordinary fire-damp consists of carbonic-acid gas, nitrogen, and water vapor; and death results from slow suffocation, due mainly to the exhaustion of the oxygen in the air.

But the after-damp from explosions of coal-dust is much more rapidly fatal, and evidently contains some more poisonous constituent. Analysis shows that this is carbonic oxide. Miners frequently work without serious inconvenience in air in the [illegible] so much carbonic acid as almost to extinguish their lights; but a proportion of carbonic oxide so small as to have no appreciable effect on his light will cause the death of the miner in a few moments, sometimes almost instantly, his light continuing to burn after his death until the oil is exhausted. It has repeatedly happened that miners who were outside of the roads traversed by an explosion, and uninjured by the explosion itself, have been cut off by the after-damp, and have perished in trying to force their way through it to the shaft. In fact, the most serious features of dust-explosions are, that, unlike gas explosions, they occur absolutely without any warning, and mainly near the shafts, thus preventing escape from any part of the mine.

Of six typical explosions occurring in the north of England in the years 1880 to 1885, five occurred in Durham, in dry dusty mines, and were undoubtedly dust-explosions. The total loss of life was three hundred and thirty, or an average of sixty-six for each explosion. The sixth explosion occurred in the Whitehaven colliery, which extends three miles under the sea, and is wet, and free from dust. This was clearly and purely an explosion of fire-damp, and the most extensive of its kind within the experience of the Messrs. Atkinson, and yet only four lives were lost. This mine was not only free from dust, but the explosion was limited to the most remote, deepest, and most poorly ventilated portion of it.

The following conclusions are warranted by the study of these explosions: all the explosions were limited to one plane or level of the colliery, in no case ascending or descending vertically so as to continue the explosion on another plane. The single gas explosion was remote from the shafts, and so cut off from communication with higher or lower workings; while all the dust-explosions extended to or even crossed the downcast shafts, but could not follow the shafts up or down because they are wet and free from dust; and, in general, the flame and violence of the dust-explosions were confined to those roads on which there was much coal-dust, their intensity varied with the amount of dust, and they were often arrested at places where the roads were wet or damp. In no case were the return airways, where gas is always most abundant, seriously affected; and the intake airways also escaped where not used for handling coal. Since the dust is naturally heavy and quiescent, it can only be ignited when some disturbance throws a cloud of it into the air in the presence of a flame. One of the dust-explosions was probably initiated by a small explosion of fire-damp; but all the others were simultaneous with the firing of shots of gunpowdér in stone; and it is concluded that the con-

cussion of the shots threw the dust into the air, and the flame of the shots ignited it. Gunpowder is in daily use in the collieries, but usually on the working face, where there is insufficient dust to start an explosion. In every case but one, however, the shots causing the explosions were fired where the miners were enlarging the main roadway, and where the dust had been quietly accumulating for years. The fresh air passing these points at the times of the explosions varied from twenty-three thousand to sixty-one thousand cubic feet per minute, so that any accumulation of fire-damp was impossible. Dust in the air may be ignited by an open light, but not by a safety-lamp. One of the curious features of the dust-explosions is, that they exhibit but little force or violence near the point of origin, but seem to require a distance of from fifty to one hundred yards in which to gain headway. Once initiated, the explosion is self-propagating, and rapidly increases in violence; the normal condition, after an explosion is fairly established, being (1) a wave of air preceding the explosion and filling the air in the roads with coal-dust, (2) flame following instantly into compressed air charged with dust.

Various popular ideas about explosions, such as that they 'face the wind' or travel against the fresh air, favor the coal-dust theory.

Under the head of remedial measures, the authors of the report note that watering the roadways, which has been practised for many years as a mere matter of convenience, is of little avail as a means of preventing explosions, since the upper dust in every instance is left undisturbed. Gunpowder should not be used in dusty places without first thoroughly dampening the dust. The accumulation of dust in the roads may be diminished by reducing the velocity of the air, which can be done by enlarging or doubling the roads; by reducing the speed of the coal-cars; or by wetting or covering the loaded cars. Extensive dust-explosions could be prevented by keeping occasional sections of the roads thoroughly wet.

Since the dryness of the mines is due mainly to their high temperatures, a large volume of air entering at 40°, and raised in its course to 70°, exercising an enormous drying power, the following more drastic remedy is also suggested: to raise the air entering the mine to the temperature of the mine, and saturate it with moisture. It could then exercise no drying power, and the natural moisture of the mine would come into play, changing dry mines to damp mines. The principal objections to this plan are the expense, and the greater discomfort to the miners of working in warm, moist air.

A more recent contribution in the Proceedings of the Yorkshire geologic and polytechnic society, for 1886, recognizes the great importance of coal-dust in colliery explosions, and shows, that, contrary to the generally accepted theory, important explosions are much more likely to occur when the barometer is high than when it is low. The explanation is, that, while a high or rising barometer tends to prevent the escape of gas from the coal, it is also usually accompanied by a dry atmosphere, which renders the coal-dust lighter and more inflammable.

## *ELECTRIC RAILROADS IN THIS COUNTRY.*

AN interesting article on electric railroads in the United States, by T. C. Martin, appeared in a recent issue of the *Railroad gazette*. The progress already made in the application of electric energy as a motive power for street-railroads, as reviewed in Mr. Martin's article, cannot fail to be encouraging to all engaged in the development and exploitation of inventions in that particular field of industry. Nor is it without interest to scientific men and the public generally. One electric road in Baltimore, equipped by the Daft company, has been in successful and profitable operation about two years. A road in Los Angeles, Cal., built by the same company, has been running several months, and is soon to be extended to nearly double its present length. This company is also constructing and equipping electric railroads in Pittsburgh, Penn., and Orange, N.J., and will construct others at Mansfield, O., and Ithaca, N.Y.

The Van Depoele company of Chicago is able to show a good record in the matter of electric-railroad construction. Roads using its system of electric propulsion are running at Port Huron and Detroit, Mich.; Appleton, Wis.; Windsor, Ont.; Scranton, Penn.; and Montgomery, Ala.; which last-named city has eleven miles of road in operation. This company is now constructing roads at Lima, O., and Binghamton, N.Y.

In Denver, Col., there is an electric road, constructed on what is known as the Short-Nesmith system, in which the current conductor runs in an underground tube, contact being effected through a five-eighths inch slot between the rails. This road crosses eight horse-car tracks, five steam-car tracks, and a two-hundred-foot bridge.

A three-mile road in Detroit uses the Fisher system of equipment, and a short line in Pittsburgh is being equipped on the same system. A nine-mile section of road in San Diego, Cal., intended for high speed, will be constructed by a company which has just completed a double-track road in Kansas City. These two are overhead conductor roads. A Philadelphia company, which

has already constructed a short line in that city, is at present busy on the construction of mining roads; one of these, now under way, being six thousand feet long, and wholly in the mine. The Sprague company of this city has completed a short road for a Boston sugar-refinery, and is now making estimates for street-lines in several of our larger cities. This company has made a series of tests with storage-batteries for street-car purposes, which have given very satisfactory results.

A cross-town line in this city is to be equipped with the Bentley-Knight conduit system, — a system specially devised to meet the requirements of street-car traffic in crowded city streets. A road in Allegheny City, Penn., is contracted for by the Bentley-Knight company. On the Eighth Avenue road in this city, and also on a road in St. Louis, the Julian storage-battery system has been tried, and, it is claimed, with results showing economic features as compared with horse-traction.

After referring to the many systems still in the purely experimental stage, Mr. Martin concludes as follows: "At Ansonia, Conn., an electric road, three and a half miles long, from Derby to Birmingham and Ansonia, using overhead wire, has been contracted for. It will be used for both freight and passengers, and power to drive the dynamo will be taken from the Housatonic dam. At Newton, Mass., a road is to be built by a company already formed; one is proposed for Worcester, Mass. At Brookline, Mass., two will soon be in operation, and one each is in view at Bangor and Biddeford, Me. Two roads are contemplated in Brooklyn, one at Coney Island, and one at Rockaway. Pelham Park, N.Y., is to have a road this summer, and Asbury Park, N.J., is advertising for bids on another. Franchises are asked for a road in Jersey City and Bayonne; and Plainfield, N.J., is also wanting a road. In Pennsylvania, Scranton, with one successful road, is to have another, and probably two. A road is to be built from Carbondale to Jermyn, four miles. In Reading, the Perkiomen Avenue company proposes to adopt electricity. Harrisburg is to have a road, and it looks as though, before the end of the year, Pittsburgh will have half a dozen. Down south, steps have been taken to construct new electric roads, or adopt the system on old roads, in Jacksonville, Fla.; Pensacola, Fla.; Birmingham, Ala.; Selma, Ala.; Atlanta, Ga.; and Fort Smith, Ark. Among roads spoken of in Ohio are several at Cincinnati, Cleveland, Tiffin, and other places. Wichita, Kan., is proposing to adopt electricity for its street-cars. Lincoln, Neb., has formed a company to operate an electric railway from the business part of the town to the stock-yards. In San Francisco a road is to be built on Fillmore Street hill, and roads are also wanted at San Jose and Riverside, San Bernardino county. If I were at liberty to do so, I could add to the above list about fifty names of places where, from present indications and movements, it is safe to say that electric roads will be running within a year."

## *EXPLORATION AND TRAVEL.*

### *Sierra Leone.*

WE give elsewhere a brief sketch of the tribes of Sierra Leone. Our knowledge of this country is principally due to the commercial companies which are established on the coast, and to the endeavors of the English and French to extend their colonies towards the interior. We find some very interesting notes on Sierra Leone in letters by Lieutenant Mathews, which were published in 1791; and his descriptions of the people are still true, though a long time has elapsed, and the slave trade was long since abolished. The first to enter the interior was Major Laing, who, in 1822, succeeded in reaching the sources of the Scarcies and Rockelle, the principal rivers of the colony. R. Caillié, on his journey from the Senegal to the Joliba (the upper Niger) and Timbuktu, and thence through the Sahara to Morocco, 1824–28, crossed the territory of the Mandingos, and gave an interesting description of their customs and mode of life. In 1842, W. C. Thomson explored the district north of the Scarcies River and Futa-Jalon, where the Scarcies, Gambia, and many tributaries of the Senegal and Niger, have their sources. In 1869, Winwood Reade, who was sent out by the London geographical society, explored the country between the Scarcies and Rockelle rivers, and after having reached the town of Falaba, Major Laing's farthest point, crossed the watershed and descended the Niger, which he followed a long distance. The latest important researches are those of E. W. Blyden, who travelled in the Susu country, north of the Scarcies, in 1872, and of J. Zweifel and M. Moustier, who were sent out by the French merchant Verminck for the purpose of discovering the source of the Niger (1879). They followed Reade's route as far as Falaba, and then turned south to the head waters of the Niger. Most of these routes run parallel to the large rivers. The tributaries which are crossed by these routes are little known, and much work remains to be done before the geographical features of the country and the ethnological character of its inhabitants will be tolerably well known.

The proposed French expeditions to the upper Niger will add considerably to our present knowledge of the interior parts of this district. Owing

to the hostility of the Marabout Mahmadu Lamine, two expeditions were formed last December to proceed against him (*Proc. roy. geogr. soc.*, April, 1887). The country to be traversed is little known, and topographical surveys will be carried on during the expedition. Besides this, Dr. Tautain and Lieutenant Quiquandon will explore the country adjoining the north-eastern boundary of Senegambia, which includes the country called Bakunu, between the desert and the upper course of the Niger. It was traversed by Mungo Park in 1796. A third party will survey the unknown part of the Niger, as far as it forms the boundary of Senegambia, and ascend the Tankiso, which has its source in Futa-Jalon, and has never been visited.

*Asia.*

H. E. M. James, F. E. Younghusband, and H. Fulford have made an interesting journey in a part of Manchuria which had hitherto not been visited by Europeans. They left Mukden, the capital of South Manchuria, on May 29, 1886, intending to ascend the Yalu River and to reach the point where the Chinese, Korean, and Russian frontiers meet. They were prevented from carrying out their intention by the impracticability of the upper valley of the Yalu. Therefore they turned due north, up one of the tributaries of the Yalu, crossed the main chain of mountains by a low pass 2,700 feet high, and came down the Tang-ho, an affluent of the main or western branch of the Sungari. They then visited the Chang Pei-shan ('ever white mountain'). It was found to be a recently extinct volcano, with a lovely blue pellucid lake filling the bottom of the crater, and surmounted by a serrated circle of peaks rising about 650 feet above the surface of the water. The loftiest of these was found to be 7,525 feet high, while formerly its height was estimated at 10,000 to 12,000 feet. The sides of the mountain are composed of disintegrated pumice, to which its conspicuously white aspect is due. There are no glaciers, but snow lies in the clefts all the year round. The Pei-shan forms the centre of the river-system of Manchuria; the Yalu, which forms the southern part of the Korean frontier, the Tumen, which forms its northern part, and the western Sungari, having their sources here. From here the party went to Kirin, descending the Sungari. While the rest of Manchuria is infested with robbers, the colonists and hunters of this district have managed to suppress them, and travelling is comparatively safe. Considerable difficulties were experienced owing to incessant rains, which made the rivers impassable. Numerous gold-diggings were met with, the most extensive being but a few marches from Kirin. Here they staid for three weeks, and started on Sept. 3 for Tsitsihar, the capital of northern Manchuria, on the Nonni, a tributary of the Sungari. From Tsitsihar they turned south-east, and crossed a high, undulating, and perfectly uncultivated steppe, with numerous brackish lakes. At the shores of these lakes, earth containing soda and salt is gathered, from which soda and salt are made. Thus they reached Hulan, on the Hulan River, a few miles from the Sungari. The country all around here is very fertile, and is being rapidly settled, some of the towns having upward of 25,000 inhabitants. They visited the south-east corner of Manchuria, where the Russian, Korean, and Chinese frontiers meet, and returned to Kirin and Mukden. A great part of the country they traversed was never visited by Europeans, and the compass survey of their route will be very valuable (*Proc. roy. geogr. soc.*, Dec., 1886; April, 1887).

*America.*

*La gazette géographique* (April 21) says that Chaffanjon's explorations on the upper Orinoco have been successful, and that he has returned to Ciudad Bolivar.

Thouar's expedition, which was sent out to explore the Pilcomayo, is detained at Lagunillas, on account of the outbreak of cholera in Paraguay.

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## NOTES AND NEWS.

THE second annual meeting of the American economic association will be held in Boston and Cambridge, May 21–25, 1887. The meetings will, for the most part, be held in the buildings of the Massachusetts institute of technology; but one session will be held at Harvard university in Cambridge. The following is the programme, subject to revision: May 21 (evening), joint session of the American economic association and the American historical association, with addresses by the presidents of the two associations (Gen. Francis A. Walker and Prof. Justin Winsor), reception of both associations in the Museum of fine arts; May 23, report of the standing committee on transportation, 'Agitation for federal regulation of the railways' (by Prof. E. J. James), 'Long and short haul clauses of the federal railway law' (by Dr. Edwin R. A. Seligman), 'Some curious phases of the railway question in Europe' (by Simon Sterne, Esq.), 'Sociological character of political economy' (by F. H. Giddings, Esq.), and 'Mine labor in the Hocking valley' (by Dr. Edward W. Bemis); May 24 (forenoon), economic association, report of committee on trade on 'Condition and organization of retail trade,' report of standing com-

mittee on public finance on 'Municipal public works,' paper by Frank J. Goodnow on the 'Administrative aspect of municipal franchises and finance in Europe and America;' (afternoon), joint session of both associations (Saunder's theatre, Cambridge), papers by Hon. Carroll D. Wright on 'The study of statistics in colleges,' by Prof. E. J. James on 'Our legal tender decisions,' and by Dr. A. B. Hart on 'Finances of the American revolution;' (evening), meeting in Boston, paper by Professor Folwell on 'Economic theory,' paper by Prof. Richmond Smith on 'Wage statistics,' report on the Connecticut valley branch of the American economic association by Dr. E. W. Bemis (secretary), report of the secretary on the 'Condition and prospects of the American economic association;' May 25, both associations will go to Plymouth, and dine together at the Samoset House.

— A letter from Mr. Tebbutt in the April number of the *Observatory* states that the 'great southern comet,' to which we have already referred in *Science*, was first seen at Windsor, New South Wales, on the evening of the 28th of January. The tail was many degrees in length, and extended as far as the star Achernar in the constellation Eridanus, but no nucleus could be detected on that evening or on the evening of Jan. 30. On Feb. 1, although the sky was pretty free from cloud, not the slightest trace of the tail could be seen, owing to the brilliancy of the moon. No accurate observations were obtained, and the comet was not seen again. The *Revista do observatorio* for February, published by Dr. Cruls at Rio Janeiro, gives a sketch of the comet made on Jan. 24, 1887. The nucleus was then somewhere beyond the bright star $\alpha$ Gruis, invisible in the haze of the horizon; and the tail stretched up beyond $\beta$ Hydrae, a narrow ribbon fifty-two degrees in length and about half a degree in width. At Cordoba no accurate observations could be made on account of the lack of a definite nucleus. Dr. Thome has expressed the opinion — though, as he says, the evidence is not such as would be accepted by astronomers as conclusive — that the comet is identical with the great comet of 1880, to which it bears a strong resemblance in its physical characteristics. The great comets of 1843, 1880, and 1882, and the comet discovered during the total eclipse of the sun of May, 1882, all seem to be moving in similar orbits, and doubtless belong to the same family, having formed at some earlier stage parts of a single body. The Melbourne comet is now, without doubt, to be added to the family, and there may be many other large comets in this stream, which pass by the sun unobserved. Dr. Meyer's recent investigations show, that, if any one of these brilliant comets had passed perihelion in May, its position with respect to the sun would have insured its escape. Dr. Meyer is not inclined to admit the identity of the comets of 1843, 1880, and 1882.

— Commander F. E. Chadwick, of the navy, contributes to the May number of *Scribner's magazine* an important article, entitled 'The development of the steamship,' in which he describes the first experiments in steam-navigation, the early lack of faith in its possibilities, the obstacles that were overcome, the rapid improvements in steamships, the growth of ocean transportation, and the establishment of the great transatlantic lines. An especially interesting feature of the article is the description of the most famous of modern steamships.

— The publication of *The journal of education for New Brunswick* has met with such encouragement that it has been determined to enlarge it to a twenty-four page paper, to be published monthly, in the interest of teachers and students of the maritime provinces of Canada. The first number of this periodical will be published about the first of June next.

— Within three months of the appearance of the first part of the new series of his 'Butterflies of North America' (see *Science*, ix. 122), Mr. W. H. Edwards issues another, which is even more interesting than that, for two of the three quarto plates furnish abundant details of the early stages of butterflies, heretofore unknown, and including many not usually given by naturalists. The first of these is Colias harfordi of southern California, which the author has been able to raise in the east from eggs sent by Mr. Wright of San Bernardino, — a collector who has done much to develop our knowledge of the butterflies of that region. The other is Neonympha gemma, a southern insect, not uncommon in West Virginia. This last plate contains also N. henshawi of New Mexico, of which the egg also is given; and the whole plate, in delicacy of drawing and faithfulness of coloring, is matchless, and reflects the greatest credit upon all concerned. Argynnis comes in again for its share, one species, A. coronis, being figured, and another, A. calippe, having a page of its history recorded from the notes of Mr. Wright, from which it appears, that, in contrast to our eastern species, it flies in spring, and in spring only. It is much to be hoped that the Boston publishers (Houghton, Mifflin, & Co.) will be able to assure the author in a substantial manner of the growing appreciation of the public for such excellent work and costly outlay.

— The well-known Woburn rotation experiments, undertaken by Voelcker for the Royal agricultural society of England, have been frequently quoted as casting discredit upon the conclusions of the chemist regarding the manurial value of different articles of cattle-food (see article in *Science*, ix. No. 206, for an account of these experiments). The manure from animals fed with cottonseed-meal, in particular, showed no superiority over that from animals fed with corn-meal, although the former must have been much the richer in plant-food. Those, however, who interpreted the experiments unfavorably to the conclusion of the chemist, forgot that the soil is as important a factor as the manure in the production of a crop, and that upon an already fertile soil the direct fertilizing effects of manures may have no opportunity to show themselves; some other factor being present in relative minimum, and thus controlling production. In the last number of the Journal of the Royal agricultural society, Voelcker reports briefly upon the beginning of a similar experiment upon *poor soil*. Few details are given; but the general result was that the manure from cottonseed-meal greatly surpassed that from corn-meal, thus indicating strongly that the soil of the Woburn experimental field was too rich for the proper conduct of experiments with fertilizers, and giving a very plausible explanation of the abnormal results reached.

— A system of indicating the time at night throughout a district lighted by electricity from a central station has been patented by Patrick B. Delany, an electrician of this city. The system consists in causing all the electric lights in the district to fluctuate in intensity, in a predetermined manner, at proper intervals, and in such a way as to indicate the hour.

— Mr. E. C. Sanford of the Johns Hopkins university has republished, with an introductory note by Prof. Stanley Hall, his study of the manuscripts of Laura Bridgman, the famous blind deaf-mute now living, at the age of fifty-seven, at South Boston. The author has had access to almost all of the diaries and other writings which Laura Bridgman has from time to time written, and has given a valuable as well as interesting analysis of their contents. Her autobiography is given almost entire, and abounds in quaint errors, such as normally constituted persons would seldom if ever commit. These are sifted out and presented with much tact, and the whole study is an important contribution to the history of one of the most remarkable educations through which a human being ever passed.

— About two years ago, Mr. de Nicéville of the Indian museum, Calcutta, sent for exhibition to the entomological society of London several series of Indian butterflies, which were universally regarded as distinct species, but which closely resembled one another, excepting that the conspicuous ocellated spots of the under surface of the wings of certain kinds found in the rainy season were replaced in other kinds which fly only in the dry season by more uniform, paler, and leaf-like markings, in which the ocelli are obsolete. He regarded these as probable instances of seasonal dimorphism, — a view which was vigorously combated by some of the members present at the exhibition. He has now proved his right to the belief in the case of four pairs, having raised one series of forms from eggs of the other (*Journ. Asiatic soc. Bengal*, 1886). These were species of Yphthima, Mycalesis, and Melanites, and it is the first time this phenomenon of seasonal dimorphism has been shown in tropical butterflies; it was supposed to be altogether related to the winter of temperate regions. Mr. de Nicéville believes that the obliteration of the ocelli is "an advantage to the insects during the cold and hot seasons, as at those times the vegetation is much more scanty and dried up, the insects live chiefly among the grass, and would consequently be easily seen were they not inconspicuously colored and marked; while in the rains, the vegetation being then very dense, they can hide themselves, and their conspicuous livery is no bar to their safety." De Nicéville adds at the end of his paper (in which the early stages of Yphthima and Mycalesis are for the first time figured) that he could indicate "many dozens of Indian species" in which he believes seasonal dimorphism occurs, "including nearly every family into which butterflies have been divided," but he "might again be accused of 'guessing.'" Here is certainly an interesting and open field for the Indian entomologists, which even the tyro may till.

— Excavations for the foundations of the 1000-foot iron tower to be erected in the Champ de Mars, Paris, are being made. Each of the four members of the tower framework will rest upon a pyramid of masonry 26.24 feet high, to which it will be secured by anchor-bolts six inches in diameter. Four immense masses of beton, resting on a stratum of clay nearly fifty feet below the surface, will serve as foundations for each of the masonry pyramids; and the enormous weight of the whole will act as a counterpoise to insure the stability of the tower against the great wind-pressure to which it will be subjected.

— Messrs. Ticknor & Co., Boston, have recently published, under the title 'American literature

and other papers,' a volume of essays by Edwin P. Whipple, in the introduction to which John G. Whittier says of the author that he was the ablest critical essayist of his time, and the place he has left will not be readily filled. Scarcely inferior to Macaulay in brilliance of diction and graphic portraiture, he was freer from prejudice and passion, and more loyal to the truth of fact and history. He was a thoroughly honest man. He wrote with conscience always at his elbow, and never sacrificed his real convictions for the sake of epigram and antithesis. He instinctively took the right side of the questions that came before him for decision, even when by so doing he ranked himself with the unpopular minority. He had the manliest hatred of hypocrisy and meanness; but if his language had at times the severity of justice, it was never merciless. He 'set down naught in malice.'

— The well-known researches of Warington have done much to elucidate the process of nitrification as it takes place in the soil. His latest paper (*Journ. chem. soc.*, Feb. 1887, p. 118) deals with the distribution of the nitrifying organism in the soil. Evidences of its presence were found to the depth of six feet, but it was neither abundant nor vigorous. The author concludes that nitrification is practically confined to the surface soil.

— The lactocrite, a new apparatus for testing milk, particularly with regard to its value for butter, is the invention of de Laval, also the inventor of the well-known centrifugal separator, which bears his name, and is designed to be used with the latter. The milk is first heated with its own bulk of strong acetic acid to which five per cent of strong sulphuric acid has been added. This treatment, continued for seven or eight minutes, suffices to set free the fat of the milk from its emulsionized state. A glass tube with a narrow neck, properly graduated, is then filled with the milk, placed in a suitable holder in a disk which is attached to the centrifugal separator, and the latter set in operation. A complete separation of the fat is then effected in the narrow neck of the tube, where the amount is read off. The instrument is designed to enable creameries using the centrifugal to test the quality of each patron's milk; and it appears to be well adapted to this purpose. Several tests of its accuracy have been made of late. Sexhlet, in the *Milch Zeitung* (xvi. 14), reports that he obtained by it results agreeing within 0.1 per cent with those of his aerometric method. Sebelien (*Landw. Vers. Stat.*, xxxiii. 405) finds, that, if all the directions are strictly observed, the results do not vary at most more than 0.1 per cent, and usually not over 0.05 per cent, from those of gravimetric analysis, but notes that these directions must be carefully followed. Faber (*Analyst*, xii. 6) obtained about the same results. Blythe (*Ibid.*, xii. 34) found in eleven trials a maximum error of 0.14 per cent, and an average error of 0.05 per cent.

— Ginn & Co. have ready this week 'Little flower people,' by Gertrude Elizabeth Hale, an interesting elementary work on flowers, designed to awaken an interest in plant-life among the youngest readers; also 'Outlines of logic,' by Herman Lotze, translated and edited by Prof. George T. Ladd of Yale college.

— Mr. William Cushing has been obliged to give up the publication of his proposed 'Anonyms' as a companion to his 'Pseudonyms.' This is to be regretted as a loss to American bibliography. There ought to be enough public-spirited institutions and individuals — booksellers and librarians — to whom such a work is an almost daily necessity, to offer Mr. Cushing and his publishers a guaranty against loss in completing a work so admirably begun.

— With the publication of the third volume of the history of Central America, now about ready to place in the hands of subscribers, but fourteen of the thirty-nine volumes of Hubert Howe Bancroft's works remain unpublished. The History company are gratified with the success that has attended the enterprise thus far; the growing favor in which each successive volume is held by the public, and the especially kind notices and reviews of the press, generally prove a very great encouragement.

— G. P. Putnam's Sons announce that when they have completed the publication of their edition of Franklin's works, of which the third volume is about to be delivered to subscribers, they will follow this with an edition of the 'Writings of Washington,' printed in similar style. The set, which will probably be comprised in twelve volumes, will contain the diaries, the addresses, and the correspondence, and will include a number of papers not before printed. Arrangements for the editing have been in train for some months, and the name of the editor will be announced shortly. The limited edition printed of the 'Franklin's works' is now all subscribed for, and the price of sets has already appreciated, as was the case with the 'Hamilton.'

— Messrs. Macmillan are going to issue this month the second volume of the 'Course of practical physics,' by Prof. Balfour Stewart and Mr. W. Haldane Gee, dealing with electricity and magnetism.

— Two years ago Professor Baird conceived the idea of procuring one of the prehistoric Easter Island idols to be added to the collection at the national museum. After much labor and patience, his efforts, aided by the government, have been successful, and the idol arrived in Washington on Monday last, together with a number of other valuable antiquities. The curiosities have been brought over without injury and without expense, naval vessels conveying them for the entire ocean-voyage. There are hundreds of these images on the island concerning which there is no knowledge whatever. One of them was taken from the island by the German government recently, and is now in the national museum at Berlin.

— The forthcoming report of the department of agriculture on the English sparrow will be a very interesting document. It will contain about four hundred printed pages, in which will appear the experiences of about thirty-two hundred people with this destructive biped. Dr. Merriam, the ornithologist of the department, who has charge of the preparation of the report, says that the indictment against the sparrow is a terrible one; and it has scarcely a friend in the whole country. Farmers who devote their time to the cultivation of grain, report that the sparrows, wherever they are thick, do frightful damage to cereals. Market-gardeners and the raisers of small-fruit, in the vicinity of cities, say, that, since sparrows began to multiply, the profits of market-gardening have almost vanished. The only known use for the sparrow is as a substitute for reed-birds. One man in Albany, N.Y., reports that he sells hundreds of dozens of sparrows every month to the restaurants in that city for reed-birds. They make excellent table-birds.

— The Smithsonian institution has just received a large collection of birds collected by Mr. Robert Henderson in the West India islands. Mr. Henderson, who has just returned from his trip, has been engaged in this work since last December, and has covered all of the islands except Ruatan, Turneff, and Cosomel in the lower part of the Caribbean Sea. He will make a second trip this summer to the above islands.

— The *West American scientist*, a monthly issued at San Diego, Cal., has enlarged to a twenty-four-page magazine with its third volume.

— The New York mineralogical club has recently been organized in this city. The objects of the club are, to create and stimulate an interest in mineralogy, and to collect, describe, and preserve all suitable material available in New York City and vicinity; such collection to be deposited in some public institution, so as to preserve a mineralogical record of places soon to be covered with buildings. It has been decided that all meetings of the club, if possible, shall be held at the residences of the members, for the purpose of examining collections as well as promoting sociability. Meetings will be held on the last Tuesday of every month, the chairman of each meeting to be the host of the occasion. The officers of the club are, George F. Kunz, secretary; B. B. Chamberlain, treasurer; Prof. D. S. Martin, Rev. J. Seldon Spencer, and Edgar A. Hutchins, executive committee; L. P. Gratacap and A. Woodward, curators. There are already over forty members on the roll.

— Mr. Stephen Salisbury of Worcester, Mass., has just given to the Technical institute of that city one hundred thousand dollars, to be used in the erection and equipment of a building for laboratories for mechanical, physical, and chemical science, as a memorial to his father, the late Stephen Salisbury, who for a great many years was president and chief patron of the institute.

— A remarkable illustration of the puzzling migratory habits of the herring has just been observed, says *Nature*, on the south-west coast of Norway, at the so-called Jaederen, between the towns of Stavanger and Egersund. This district used to be one of the richest herring-fishing grounds in Norway during the spring, but about twenty-five years ago the fish suddenly and completely disappeared from the coast. In March enormous shoals once more came under shore, first 'striking land' at the same spot as in former times. The quality of the herring is exactly the same as it was twenty-five years ago, and the shoals were accompanied by numerous 'herring' whales.

— According to *Engineering* for April 22, Russia proposes to press forward vigorously with the construction of the Samarcand railway from the Caspian Sea to the Amu Daria. It is stated that when the line is finished it will be possible to make a journey from Paris to Samarcand in seven days. The line will commence at Ouzoun-Ada, a small port on the Caspian, the distance from that point to the Amu Daria being in round figures 625 miles. Of this distance, 543¾ miles of line are now entirely completed, and open for the conveyance of passengers and goods. The present terminus of the line is Tchardghoni, to which place it was completed Nov. 30, 1886. The construction of the line was commenced by General Arrenkoff in May, 1885, and 418¾ miles were completed in eighteen months. The number of persons engaged in the construction was about 2,200. Not only was the permanent way laid through to

Tchardghoni in the course of the eighteen months, but houses and cottages for enployees, a line of telegraph, and sand-sheds, were also established. The object of the sand-sheds is, of course, to protect the line against sand-storms, which constitute one of the difficulties with which it has to deal. Active preparations have been made for the construction of the remaining section to the Amu Daria: the necessary workmen have been collected, a large mass of materials has been brought together, and General Arrenkoff expects to complete the whole line through to Amu Daria by Nov. 15.

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## LETTERS TO THE EDITOR.

****The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Comparative psychology.

PRESS of work has prevented me from replying before to a certain form of presentation, in *Science* for April 1, of my paper published in the *Popular science monthly* for March, on comparative psychology, and which really amounts very largely to a misrepresentation not only of what I think, but of what I actually expressed in the address referred to above.

It is assumed throughout by *Science* that I have ignored Professor Morgan's view of the case as to the study of animal intelligence, for it is stated that "he [the writer] has not faced this argument," etc., and "These limitations and considerations carry with them many consequences, but we can find in Dr. Mills's address no evidence that he has ever given them any consideration."

A few extracts from my own paper, followed by others from Professor Morgan's (in *Mind* for April, 1886), will test this matter. I am quoted in *Science* as saying, "Animals are the 'poor relations' of man; the latter is one of them, not only in body, but in mind. In not a few respects they are not only equal, but superior, to man." Professor Morgan says, "I am, moreover, fully persuaded that my four-footed friends have feelings and emotions distinctly akin to and dimly foreshadowing my own;" "I by no means deny the existence of animal mind;" etc.

Again he says, "A material difference in the ratio of the senses must, we may suppose, make a material difference in the mental product." He then alludes, as I do myself after the very passage *Science* quotes from my paper, to the superiority of the senses in the animals below man; for though *Science*, referring to my use of the expression 'lower' animals, says ironically, "We presume he uses the adjective 'lower' merely in deference to a custom of some antiquity," I have explicitly stated that it must be conceded that man as a totality stands at the head of the animal world, as the following extract will show: "The assumption that man is only accidentally the superior of the brute would but lead to confusion, for it must be admitted that there is a scale, and that man ranks first. We are simply desirous of doing the lower creation that justice which we feel assured has not yet been allowed them, and of seeing the human family interested in those that we think scientific investigation is proving constantly are much more our fellow-creatures than has generally been supposed." "We are not contending for the equality of man and the rest of the animal kingdom," etc.

Again, *Science* represents me as saying that "man has only developed a superiority to the brute because of his social tendencies, resulting in the division of labour," etc.

Now, what I did actually write was as follows: "Man's present superiority over the lower animals is traceable in large part to his eminently social tendencies," etc., which is a very different thing; and I have elsewhere in the paper called attention to many other agencies which have tended to make man the supreme animal.

Professor Morgan holds, that, strictly, the only mind one can know is his own mind; that at best human psychology is a "psychology of sages, but not of savages; that all our knowledge of human minds other than our own is necessarily ejective; that our systems of human psychology hold good only for the philosophers who frame them; that over-ejective inferences concerning our neighbours' minds, motives, and characters, are liable to error."

Now compare with this the following from my own paper: "And at this point allow me to indicate a danger that should make us cautious and modest in attempting to explain the behavior of animals. We infer from our fellow-man's behavior similarity of motive and mental processes to our own under like circumstances. We find, the more experience we have, that we are often at fault as to both. And when we are more free from the thraldom of so-called systems and methods in education, we may learn that the activities of the human mind cannot be reduced in all persons to precisely the one plan, like so much clock-work. This may mar somewhat the completeness and beauty of our philosophy of education, but it may also in the end conduce to human progress by providing the greater freedom, and end in insuring an individuality of character which seems to be now rapidly disappearing. Now, if individual men so differ in psychic behavior, how much more is it likely that still greater differences hold for the lower animals! An objection may be based, however, on this to the whole study of comparative psychology. The objection holds to some extent even for human psychology; but, as we infer similarity of behavior in men to denote similarity of inner processes, so are we justified in the same as regards the lower animals, though it must be conceded somewhat less so. We must always be prepared to admit that there may be psychic paths unknown and possibly unknowable to us in the realm of their inner life. But if we regard man as the outcome of development through lower forms, according to variation with natural selection — in a word, if man is the final link in a long chain binding the whole animal creation together, we have the greater reason for inferring that comparative psychology and human psychology have common roots. We must, in fact, believe in a mental or psychic evolution as well as in a physical (morphological) one."

How, in the light of these extracts, *Science* can say, "We can find in Dr. Mills's address no evidence that he has ever given them [Professor Morgan's views] any consideration," it is difficult for me to understand.

Now, Professor Morgan bases his belief in the mind of the lower animals on, 1°, "*the justification by results*. We habitually act towards our four-footed friends as if they were conscious beings, with results which point to the correctness of our hypothesis." 2°. "*The justification based on evolution*. Animals have inherited brain-structures in many respects similar to those possessed by man, and there is no reason for supposing that in them no psychoses run parallel or are identical with their neuroses." Now, the whole tenor of my paper shows that I have adopted a similar line of reasoning.

It will be perceived that up to this point Professor Morgan and myself are very much in accord. The difficulty which Professor Morgan feels in regard to all our knowledge of minds other than our own is one that occurred to me many years ago with great force. The views expressed in the address now under consideration were penned months before I had read Professor Morgan's paper in *Mind*; and it was with much gratification that I found my own opinions, formed independently, shared by so able a thinker. Professor Morgan's position may be logically impregnable; but while there is need for the greatest caution in regard to the 'eject' we form, it seems to me impossible for one, at least, who believes in the *evolution* of mind, to agree with Professor Morgan, "that our ejective inferences concerning their motives, minds, and characters, are so largely liable to error as to render the drawing of them unprofitable for purposes of scientific investigation, except in so far as they may aid the objective study of habit and activity."

Professor Morgan defines *intelligent* actions as "those which are performed by the individual, in virtue of his individuality; in special adaptation to special circumstances." Now, is it *possible* to understand this adaptation at all except by some sort of 'eject'? Professor Morgan's views, if pressed, strike at the root of all psychology as a science. There is great need of such caution, as he and I myself have urged; but the belief is irresistible that the inner life of the lower animals is not totally and radically different from our own.

It seems to me the whole difference between Professor Morgan and those who would, like myself, be a little less conservative as to the 'eject,' is that of mere *quantum*; and, as psychology does not admit of exact weighings and measurings, in the present state of knowledge it cannot be expected that men will agree as to how far we shall be justified in using the ejective method. But of one thing I am fully convinced, that the study of the psychology of the lower animals cannot but improve the highest, whether he considers himself of them or apart from them.

In conclusion, I think it will now appear that *Science*, Professor Morgan, and myself are much more in harmony than was supposed.

T. WESLEY MILLS.

Montreal, April 23.

[We print Dr. Mills's lucid communication with much pleasure. He brings out very clearly the fact which we did not gather from the reading of the address in question, namely, that he has not only read but carefully weighed Professor Morgan's argument. We still think, however, that this fact is not readily inferrible from the original address without the emphasis of the present letter. — ED.]

## The relations of the International geological congress to geological workers.

A very wide-spread misapprehension exists of the purposes of the International geological congress which is to hold its fourth session in London next year, as well as of the definite steps it has taken in the way of recommendations to geologists.

In order to throw some light on the matter, the following list has been prepared, which includes all the points upon which the congress has expressed a decided opinion. It ought to be remembered that this congress has not any interest in maintaining this or that theory, but has been organized by geologists, of geologists, and for geologists (to slightly alter Lincoln's noble definition of our republic).

It has no authority but that of the influence of the large number of eminent geologists who either compose it or support its conclusions; yet when one considers the advantages which must result from agreeing upon a common scientific language (written and spoken) whereby widely separated observations may be made comparable, and may be utilized by persons of any nation as soon as they appear in print, to add to their own observations, and thus form base lines from which to triangulate to new generalizations, it does not seem to be a fatal objection to these recommendations either that they have not attained perfection, or that it may be found desirable with later experience to modify them.

It is apparent from the modest number of decided preferences which the congress has yet expressed, that it will not be difficult for any geologist to adapt to its large framework any provisional scheme which he may prefer. It is only those having strongly defined prejudices in antagonism to the broadest generalizations generally accepted among geologists, who will have any difficulty in joining in the acceptance of the recommendations of the congress.

1. The congress voted (solely for the purpose of bringing out the map) that a gray color should be provisionally chosen, of which different tints should be applied to the carboniferous and Permian (*Report of Amer. com.*, p. 20, ¶ 3).
2. Solely for the purpose of printing the European map, the committee on the map was authorized to select a color for the Silurian (Cambrian inclusive), but this choice was not to affect the scientific question connected with the classification at all (*Ibid.*, p. 21, ¶ 1).
3. The eruptive rocks were to be represented by seven tints, ranging from dark to light red (*Ibid.*, p. 21, ¶ 3).
4. The solution of other questions which might arise in the construction of the map were left to the committee on the map (*Ibid.*, p. 21, ¶ 4).
5. The congress decided that 'Archaean' should be the term applied to the group preceding the paleozoic (*Ibid.*, p. 23, ¶ 2).
6. The congress agreed to abandon Protogine as a division of rocks (*Ibid.*, p. 23, ¶ 10). The division of the Cambrian and Silurian was postponed till the congress at London.
7. The upper limit of the Devonian was placed at the base of the carboniferous limestone, that is to say, that the system comprises the psammites

of Condroz and the upper old red (*Ibid.*, p. 26, ¶ 1).

8. "The congress, not wishing to pronounce any view on the scientific question of the proper division of the Permian and carboniferous, preserves the classification as it now is" (*Ibid.*, p. 31, ¶ 4).

As to the tertiary and the eruptive rocks, no action was taken; but, for the purpose of bringing out the map, sufficient discretionary power was lodged with the committee (*Ibid.*, p. 32, ¶¶ 8 and 14).

This is all, and it does not look much like an attempt at usurpation.

As for the colors and symbols used on the map, they are purely tentative, and designed to furnish a test on a sufficiently large scale to enable all defects to be seen and subsequently corrected.

PERSIFOR FRAZER.

Philadelphia, May 2.

## City feeding of milch-cows.

In *Science* for April 29 is an editorial note on the use of distillery slops in feeding milch-cows, in which you say, "It is well settled that distillery swill in any amount is an unnatural food for milch-cows, and that the milk produced from animals so fed is unwholesome and injurious." Will you please indicate the source of the 'ample evidence' which you claim 'will demonstrate' 'that distillery swill is totally unfit food for milch-cows?' I have tried to keep informed upon this subject, but have failed to find any trustworthy evidence to support your propositions. On the contrary, milk from swill-fed cows is often of better quality — so far as we are able to demonstrate this chemically — than milk from cows poorly pastured. The important point to remember, it seems to me, is that the animals should be well stabled. It is as important to the health of cows that their habitations should be clean, dry, warm, and well ventilated, as it is to human beings. If boards of health would see to this, the swill-milk problem would bother them in a much less degree than it does at present. GEORGE H. ROHÉ.

Baltimore, May 2.

[In the report of E. H. Bartley, M.D., chief chemist of the Brooklyn board of health, made in 1886, occurs the following paragraph: "The very objectionable practice of feeding distillery waste — a practice that three years ago was, during the cold weather, almost universal — has been almost broken up. This result alone is of incalculable benefit to the consumers of milk, as such milk is without doubt a dangerous food for infants, especially in warm weather." In other reports by Dr. Bartley the question has been fully discussed, and the evidence therein contained seems to be conclusive on the unwholesomeness of this food. Some ten years ago the sanitary superintendent of Brooklyn communicated with the health officers of the large western cities where distillery swill was extensively used in the feeding of cows, and received from them statements which satisfied him that this material was entirely unfit for the food of milch-cows. As a result of this investigation into the subject, together with the experience had in Brooklyn and its vicinity, swill-feeding has not been permitted within the jurisdiction of the Brooklyn board of health. The New York state penal code, section 662, provides that a person who keeps a cow for the production of milk, and feeds such cow upon any food that produces impure or unwholesome milk, is guilty of a misdemeanor punishable by fine and imprisonment. Section 669 states that the words 'impure and unwholesome milk' shall include all milk obtained from animals in a diseased or unhealthy condition, or which are fed on distillery waste, usually called 'swill,' or upon any substance in a state of putrefaction or fermentation. The most recent law passed by the New York state legislature touching this question is chapter 183, laws of 1885. This act declares that milk from animals fed on distillery waste is "unclean, unhealthy, impure, and unwholesome." We think that the general opinion of sanitarians is that the feeding of distillery waste to milch-cows should be prohibited rather than encouraged, which will be the effect of the Philadelphia regulation if enforced. — ED.]

## Queries.

1. ARCHEOLOGICAL AND ETHNOLOGICAL COLLECTIONS. — I am aware that considerable ethnological work is done by private persons and institutions in America, but the results of their researches are difficult to obtain. The queries of *Science* seem to me an excellent means of getting information which it would be difficult to obtain in any other way. Readers of *Science* will oblige me by informing me of name and place of private and public archeological and ethnological collections, particularly in the western parts of the United States and Canada. — FRANZ BOAS, 47 Lafayette Place, New York.

2. GASEOUS ENEMATA IN THE TREATMENT OF CONSUMPTION. — I desire to obtain results of the new treatment of pulmonary consumption and phthisis by gaseous enemata, for publication in *The polyclinic*. The correct therapeutic value of this method can only be arrived at by the collection of statistics, and I therefore request any one who has administered the gas to communicate the result to me, the formula used, and any special information that may be useful. — HENRY LEFFMANN, editor of *The polyclinic*, P.O. box 791, Philadelphia.

3. ORIGIN OF CONSUMPTION. — I have been much interested in the theory of consumption which has been suggested by Mr. Hambleton, and which was described in *Science*, ix. No. 221, but cannot agree with all his inferences. He says that the natives of America, Africa, and the South Sea Islands were entirely free from consumption till they came into intimate relationship with civilized Europeans, and that the disease then came among them because they adopted the habits of the civilized nations. This seems to me to be a very weak argument. The same is true of syphilis, small-pox, measles, and other diseases, and yet I presume no one would explain their introduction in this way. Is not the fact stated by Mr. Hambleton one of the strongest arguments in support of the contagious theory of consumption? Not until the germ, the bacillus tuberculosis, was introduced, did the disease occur, and then it spread among the natives in the same manner as small-pox and other communicable diseases. That narrow chests and impeded respiratory movements are conditions favorable to the production of consumption no one doubts, but that they can actually produce the disease seems incredible. — MEDICUS.

## Calendar of Societies.

*Philosophical society, Washington.*

*April* 23. — William Harkness, On an apparatus for viewing the sun by light of any desired wave-length; M. H. Doolittle, W. D. Johnson, H. G. Ogden, Gilbert Thompson, A symposium upon the question, What is topography?

*April* 27. — A. S. Flint, On the most probable value of the latitude, and its theoretical weight, from entangled observations occurring in the use of Talcott's method; E. B. Elliot, On the mutual action of the elements of electric currents.

*Biological society, Washington.*

*April* 30. — Marshall McDonald, Explanation of past failures in the culture of the Salmonidae; J. H. Kidder, Specimen of concoction found in a cod-fish; Grass balls from Pyramid Lake; G. Brown Goode, Notes on the color of fishes; F. A. Lucas, On the os prominens in birds; W. T. Hornaday, Civilization as an exterminator of savage races; William H. Dall, A genus of mollusks new to North America.

*Anthropological society, Washington.*

*April* 19. — Amos W. Hart, Reading character by physical signs, with practical illustrations.

*Boston society of natural history.*

*May* 4, *election of officers.* — President, F. W. Putnam; vice-presidents, John Cummings, G. L. Goodale; curator, Alpheus Hyatt; honorary secretary, S. L. Abbot; secretary, Edward Burgess; treasurer, Charles W. Scudder; librarian, Edward Burgess.

S. H. Scudder, The introduction and spread of the cabbage-butterfly in North America, 1860–86.

*Society of arts, Boston.*

*April* 28. — P. H. Dudley, Railway-tracks, and a brief description of the dynagraph and track-inspection car.

*Boston scientific society.*

*April* 26. — C. W. Willis, Notes on the geology of Massachusetts; A. V. Garratt, The theory and development of dynamo machinery.

*Engineers' club, St. Louis.*

*April* 20. — C. W. Clark, Experiments with submerged ajutages.

## Publications received at Editor's Office, April 18-23.

CRANDALL, A. R. Report on the geology of Elliott county. (Geol. surv. Ky.) Frankfort, Ky., State. 28 p. 8°.

ERCKERT, R. von. Der Kaukasus und seine Völker. Leipzig, Frohberg. 385 p. 8°.

HOOVER, W. Cometary perturbations. Wooster, O., Wayne co. herald pr. 18 p. 8°.

HOROWITZ, V. J. Marokko. Das Wesentlichste und Interessanteste über Land und Leute. Leipzig, Friedrich. 215 p. 8°.

JEWISH exponent. A weekly journal devoted to the interests of the Jewish people. Vol. i. No. 1. *w.* Philadelphia, Jew. exp. publ. co. 12 p. f°.

KAPPLER, A. Surinam, sein Land, seine Natur, Bevölkerung und seine Kultur-Verhältnisse mit Bezug auf Kolonisation. Stuttgart, J. G. Cotta. 383 p. 8°.

KETTLER, J. I. Zeitschrift für wissenschaftliche Geographie unter Mitberücksichtigung des höheren geographischen Unterrichts. Band vi. heft 1. Weimar, Geographisches Institut. 44+10 p. 8°.

ORTON, E. Preliminary report upon petroleum and inflammable gas. (Geol. surv. Ohio.) Columbus, A. H. Smythe. 200 p. 8°. $1.

RANKE, J. Der Mensch. Band i. heft 1. Leipzig, Bibliographische Institut. 48 p. 8°.

—— The same. Band ii. Leipzig, Bibliographische Institut. 613 p. 8°.

SERBATI, A. R. The ruling principle of method applied to education. Tr. by Mrs. William Grey. Boston, Heath. 363 p. 12°.

WHIPPLE, E. P. American literature and other papers. Boston, Ticknor. 315 p. 12°. $1.50.

YORKSHIRE geological and polytechnic society. proceedings of the. Vol. ix. part ii. Halifax, Eng.. Whitley & Booth, pr. [192] p. 12°.

# SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 6, 1887.

## ETHNOLOGICAL NOTES.

### *The tribes of Sierra Leone.*

THE journal of the Anthropological institute, for February, 1887, contains a description of the tribes of Sierra Leone, by T. R. Griffith. The colony is not the place to study the characteristic features of African man, as its population is a conglomerate of an enormous number of African tribes, the colony having been for many years the place to which were carried all liberated slaves rescued by British men-of-war. It is of considerable interest to study the development of such an aggregate of natives of various parts of Africa, particularly as they are under the influence of powerful and homogeneous tribes which inhabit the interior. Griffith states that the amalgamation of these elements is going on very slowly, and that exclusive tendencies still prevail. A peculiar dialect of the English language is now spoken by the inhabitants. Besides the population of liberated slaves, we find the so-called Nova-Scotians and the Maroons. The former are the descendants of American negroes who had fought under the English flag in the American war, and were first transferred to Nova Scotia, then in 1792 to Sierra Leone. The Maroons had lived in the mountains of Jamaica, and had claimed their freedom when England took that island from the Spaniards. The latter are mixed with Spanish and probably Carib blood. They have a quarter of their own in Freetown. Both Nova-Scotians and Maroons are remarkable for their dislike of agriculture. There are some permanent residents from other parts of Africa, who form a distinct part of the population, — the Akus, who are liberated slaves from Yoruba, a state west of the Niger and near Lagos; the Ibos, from the same country; and the Krumen. The last-mentioned people are the well-known seamen of Africa, who serve on European steamships, and are the most industrious of the coast tribes. Their home is east of Cape Palmas. In Freetown they occupy a quarter of their own, the population of which is almost entirely masculine. There are several large rivers in this district, of which the Sarcies and Rockelle are the most important. The country between these rivers is inhabited by the Timene (Timmani), who formerly possessed the peninsula of Freetown also. Their northern neighbors are the Susu, — a people of mixed origin, being originally a branch of the Mandingo, who conquered their present country, and intermarried with its former inhabitants, the Bagas. The Mandingo occupy the highlands east and southeast of Sierra Leone. It seems that the state of all these tribes has little changed since the beginning of this century: for the description of Major Laing, who travelled in the Timene country in 1827, agrees well with Griffith's remarks. The Mandingos are Mohammedans, while among the other tribes the ancient belief still prevails. The Mendes, who live south of the Timene, are, according to Griffith, "thorough pagans, and probably there is no tribe near to Sierra Leone that indulges so much in superstitions of every description." Among the Susu and Timene there are many Mohammedans. Besides these, the Sherbros and Vei live in the colony, the latter being well known on account of the invention of a written language.

Among the peculiar institutions of these tribes, the secret societies, which have a great influence on public life, are particularly remarkable. There is a society of women, called Bundu, and another one of men, called Porô. The initiation, which takes place when the children come of age, is celebrated with great ceremony. The girls are led into the woods and kept in seclusion for one moon and one day before they are allowed to return into the village. At the end of the term they receive Bundu names with great ceremony and gesticulation by some who personate 'Bundu devils' with hideous masks. The girls are then publicly pronounced marriageable. The following illustrations are three of these masks which were exhibited in the London colonial exhibition. Fig. 1 is a large white mask with red mouth and black mustache and hair, ornamented with white bark. The dancer wears, besides this mask, a belt and arm and leg ornaments of white bark. Fig. 2 is a 'Bundu devil' of the Sherbro. The whole mask is black, and so are the fringes of bark that are fastened to its lower rim. Fig. 3 is another 'Bundu devil' with a beautiful hair dress, earrings, and shells in place of the eyes. Masks of this kind are used all over West Africa. In Central Africa masks are not unknown, some being found on the left tributaries of the Kongo, others in Lunda.

The initiation of the men is called Porô or Purû, and so is their secret society. Griffith distinguishes two kinds of Porô, — the religious and the

political. The Porô is a very powerful institution, which exerts a great influence over the destiny of those countries, and in reality supersedes the power of the chiefs. The Porô arranges the affairs of the tribes, settles disputes, and makes laws. Even intertribal wars are sometimes stopped by its arbitration. Its representatives or messengers are always held sacred, and nobody dares to disobey its commands. All travellers who have entered the interior of this part of Africa tell of the predominant influence this institution exerts in the states of the Mandingos and their neighbors.

FIG. 1.

FIG. 2.

FIG. 3

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DR. GEORGE M. DAWSON contributes an important paper on the much-discussed jade question (*Can. record of science*, April, 1887). He describes two partially worked bowlders of jade which were found at Yale and Lytton in British Columbia. The occurrence of these pieces makes it evident that the material was worked at that place by cutting the hard stone by means of a thong or a thin piece of wood in conjunction with sharp sand. Besides these specimens, unworked pieces of nephrite were found in Alaska by Capt. A. Jacobson, who affirms that the Eskimos find it *in situ*. This proves that the material is found in several parts of north-western America. According to Dawson, the implements occur as far inland as the Caribu and Gold mountains, while farther inland they are rarer. The late Prof. H. Fischer and other scientists were of the opinion that jade and nephrite came exclusively from Asia, and considered its occurrence in Europe and America as a proof of early migrations. In a paper published after his death (*Archiv für Anthropologie*, 1886, p. 563), Fischer gives a very complete list of nephrite, jade, and chloromelanite objects found in Europe, which is illustrated by a map of Europe showing their distribution. The principal features of the map are the absence of nephrite in France and Germany, while jade and chloromelanite implements are scattered all over the country. Speaking in a general way, the Elbe forms the eastern limit of the distribution of these implements. Nephrite is almost exclusively found on

the lakes of Switzerland, particularly on the Lake of Constance. A few specimens have been found in Sicily, Greece, and Asia Minor. Fischer concludes from these facts that the implements were brought to Europe by a nation immigrating into France from the coast of the Mediterranean Sea, and that the material came from Asia. He supposes the same to be the case with the nephrites of the Swiss lakes. His principal reason for adopting this theory is the failure of all attempts to find the material in Europe. He is convinced that geologists and mineralogists would be just as able, to find it as the natives, in all parts of the world who discovered the usefulness of the hard and tenacious mineral, and found it in considerable quantities, which are now scattered over countries where it does not exist *in situ*. As Fischer does not prove that the European nephrite is identical with any Asiatic variety, and his conclusions derived from the distribution of the objects are rather forced, his views on the subject fail to convince us.

—A Catholic missionary was sent by Bishop B. A. Thiel of Costa Rica to the Tule or Cunos Indians of the villages of Paya and Tapaliza in Darien. His observations on these tribes have been published in *Petermann's Mittheilungen*, 1886, No. 9. Though a great number of the natives have become Christians, some of their ancient customs still prevail. The men leave the greater part of the work to the women. They go fishing or hunting, and cut wood: the women cultivate the fields. All of them drink great quantities of chicha, an alcoholic drink made of corn. They are monogamists, and the women are very chaste, adultery being of rare occurrence. The marriage is concluded in presence of the chief. Illegitimate children are drowned in the river, and the mother is severely punished. Their mortuary customs are remarkable. They dig a pit between two trees, and put the corpse into a hammock, which is fastened to the trunks, so that it hangs over the pit. Then it is covered with branches, boards, and earth. Chicha and corn are deposited in the grave. They believe that the soul does not come to rest until the ropes of the hammock are rotten and the corpse is fallen into the pit. The Indians of Tapaliza are more civilized, and do not practise these mortuary customs. Illegitimate children, however, and widows who give birth to a child after the death of their husband, are drowned. The missionary made a reliable census of the villages, which shows that Paya has 218, Tapaliza 112, inhabitants.

— In the *Archiv für Anthropologie*, 1886, p. 591, we find a German edition of B. A. Thiel's vocabularies of the Costa Rica languages, which were published at San José de Costa Rica in 1882. W. Herzog compares these Bribri dialects with other American languages, and finds that a great number of Tupi roots occur in the words of these dialects, and that the language probably belongs to the same stock.

— *Nature* says that Tippo-Tip, the famous African trader, came upon a remarkable tribe on the Kongo, to the north of Nyangwe, who do a great deal of work in copper, and whose inlaid work in that metal is of a highly artistic character. Among the same people, enormous spear-heads of very thin copper are made, some six feet in length, which serve as a kind of currency. Probably these are the Basonge, who make work of this description. It is well known that the tribes of

FIG. 4. — BATTLE-AXE OF THE BASONGE FROM LUKASI RIVER (15½ by 9¾ inches).

central Africa are very skilful blacksmiths and carvers. Wherever explorers entered those parts of the continent where the native industries were not deteriorated by contact with the whites, the spears, arrows, and fetishes are beautifully made. The accompanying sketch is drawn from an ornamental battle-axe of the Beneki, a tribe of the Basonge. The ornaments are of copper, laid into the iron blade. The handle is covered with the skin of a snake. Iron spear-heads of enormous size, which are used in festivals or as a kind of currency, are in use among the tribes of the upper Kongo.

## HEALTH MATTERS.

### Sanitary science in New Jersey.

THE tenth annual report of the state board of health in New Jersey, just issued, is fully up to the standard of excellence which that board has for a number of years maintained in its reports. For a considerable period sanitarians were accustomed to regard the annual report of the Massachusetts board of health as the model for health reports; but, when this board was merged into that of charities and lunacy, this distinguishing characteristic was lost, and to the reports of New Jersey and Michigan the meed of honor was awarded which was formerly awarded to those of Massachusetts.

In the beginning of this report, which is made to the governor of the state, Dr. Hunt, the able secretary of the board, pays a deserved tribute to sanitary science, and to the progress which it has made not only as a science, but as an art, during the past decade. He regards this progress as one of the most important and notable achievements of the age, and directs attention to the fact that practitioners of the healing art have not only recognized it as essential to their calling, but have interwoven many of its principles not less with the treatment of disease than with its prevention. Dr. Hunt refers to the great improvements which have been made in the sewerage of the cities and towns of the state, notably Atlantic City, Orange, Long Branch, and Newark. Several subjects of importance are discussed by the secretary in this portion of the report, among them being the action of water upon lead pipes, the filtration of water, bathing accidents, the regulation of cemeteries, hydrophobia, small-pox and vaccination, summer resorts, contagious diseases, sanitary oversight of schools, the history of the cases of sickness from ice-cream and milk, diseases of animals as related to human health, and the sanitary education of health inspectors. In writing on this latter subject, Dr. Hunt says that sanitary fitness for advice or administration requires special training and the acquirement of knowledge from various departments. It is not until one comes to recognize it as demanding special study and practice that either it or the individual find their proper place. In eleven of the leading colleges of Great Britain, including the universities of Oxford, Cambridge, Edinburgh, Glasgow, and Dublin, special diplomas or degrees are given for public-health qualifications. In Great Britain and its provinces there are now about two hundred and fifty of these authorized practitioners. In addition to this, the Sanitary institute gives certificates to those who successfully pass the examination.

It has been the practice of the New Jersey board, in its annual reports, to publish special papers on various subjects connected with sanitary administration, and in this report the same plan has been followed. The disposal of house-sewage in districts not provided with sewers is treated by C. P. Bassett, C.E.E.M., of Newark, in one of these papers. He condemns privy-vaults and cesspools, and praises the pail system, which has reached such perfection in Rochdale and Birmingham. In the latter city this method has reached enormous proportions; more than 40,000 pails, representing 250,000 people, being collected weekly, and carried in specially constructed wagons to the dumping-station. At this station the contents are placed in a tank, treated with sulphuric acid to fix the ammonia, dried, and bagged for sale. At Rochdale, a city of 70,000 people, the pail system costs annually less than ten cents a head. J. J. Powers, sanitary plumber of Brooklyn, contributes a paper on the work of the plumber and the disposal of sewage. This was read at the meeting of the New Jersey sanitary association, and has already been referred to in *Science*. Professor Brackett of Princeton has prepared a paper on the physical laws of pipes and fixtures, and their contents. Illuminating-gas, its history and its dangers, is discussed by J. H. Raymond, M.D., of Brooklyn. In it a concise description is given of the various methods of gas-manufacture and the fixtures in ordinary use in gas-lighting. This paper is illustrated with twenty-seven illustrations. The paper on drinking-water and typhoid-fever, by D. Benjamin, M.D., has already been mentioned in *Science*. C. Phillips Bassett, C.E.E.M., contributes a paper on roads and streets as sanitary measures, and how to construct them, in which he discusses the advantages and disadvantages of the different materials used in road-making, their cost, methods of preparation, and use.

One of the most interesting subjects discussed in this report is the hygiene of occupations. In the general introduction, written by Dr. Hunt, the diseases which affect workers in iron and glass are described, and suggestions are given for the remedying of the evils which surround this class of artisans. Among the workers in iron, the 'boilers' and their 'helpers,' stripped to the waist, are exposed to the intense heat of the puddling-furnaces, and, while perspiring from every pore, gulp down large draughts of ice-water, or stand in the open air or in a stiff river-breeze. Such sudden coolings are liable to cause congestions, which may be followed by some of their manifold consequences. The nailers suffer from 'nailer's consumption,' due to the inhalation of minute parti-

cles of iron and steel. The peculiar diseases of the glass-workers are burns, catarrh caused by the irritation of the sand, soda, lime, arsenic, and manganese used in the manufacture of glass, emphysema of the lungs, and hypertrophy of the heart, due to over-distention of the lungs from long and hard blowing.

The diseases of hatters are described by J. W. Stickler, M.D., of Orange, to be catarrh, rheumatism, 'shakes,' mercurial sore mouths, and pulmonary affections. Diseases of the lungs seem to be the most fatal form of illness among hatters; 63.5 per cent of all the deaths being due to this class, 51.8 per cent being caused by consumption alone. It is doubtful if any other trade will show such an excess of deaths due to pulmonary phthisis. The average life of hatters does not exceed forty years.

Dr. Newton of Paterson contributes an article on the diseases of workers in silk, flax, and jute. Those who are engaged in dyeing the silk suffer from bronchial, pulmonary, and rheumatic affections, induced by the hot, moist atmosphere of the dye-house, and to inflammation of the skin of the hands and arms, caused by the irritant action of the dyes. Taken as a whole, however, the trade of silk-operatives may be considered a healthful one, and devoid of the dangers common to many of the textile trades. Those who work in flax and jute are, on the contrary, subject to great dangers to their health. The 'hacklers,' those who draw the flax or jute through steel combs in order to arrange the fibres in a parallel direction, and to remove short threads and dirt, are a short-lived class. Only from fifteen to eighteen out of a hundred survive, or enjoy good health at the age of forty. This is due to the irritant action of the dust on the lungs. A person entering one of the rooms where this work is being done, from the fresh air, is immediately seized with paroxysms of coughing. The same is true of the spinners as of the hacklers. Hemp and flax dressers inhale a dust which is peculiarly irritating; and so fatal is the result, that, if a girl of eighteen commences with this work, and is regularly employed, she nearly always dies of consumption before reaching the age of thirty years.

The diseases which occur in the manufacture of rubber boots and shoes are described by J. P. Davis, M.D., of Milltown. One of these is lead-poisoning; from six to twelve pounds of litharge and white lead being added to every twenty-four pounds of gum, for the purpose of drying the rubber and giving it weight. The pressure of the last against the pit of the stomach causes soreness of the muscles, congestion of the abdominal organs, and dyspepsia. In addition to this, accidents from machinery are not infrequent, the sticky rubber drawing a hand or an arm between the rollers. This series of papers on the hygiene of occupations is a most interesting and instructive one, and cannot but do great good by directing public attention to the dangers, many of which are remediable, of artisans in occupations which are usually considered healthful and free from danger of all kinds.

The entire report is a most valuable one, and should be in the library of every one interested in the public health, as a book of reference.

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THE report of the dairy commissioner of the state of New Jersey for 1886 treats entirely of matters relating to imitation-butter, and is worthy of notice for a fairness and moderation usually conspicuous for its absence from publications relating to this subject. Aside from the report of the commissioner, it contains a somewhat extended paper upon the history and methods of manufacture of imitation-butter, and the sanitary, commercial, and legal questions relating thereto, also by the commissioner; a paper upon the chemistry of butter and its imitations, by Prof. H. B. Cornwall; a description of a method of identifying and determining coloring-matters in butter, by Prof. Albert R. Leeds; and various matters relating to the state law and its construction by the courts.

— 300,887 immigrants arrived at Castle Garden, New York, during 1886, an increase of 30,748 as compared with 1885. 997 were returned to Europe: of these, 70 were insane, 20 idiotic, 1 blind, 88 were enceinte, 8 were convicts, and 18 cripples, 350 suffered from diseases which rendered them unable to earn their living, and 437 had no means of support.

— The number of persons of unsound mind in England and Wales, Jan. 1, 1886, as reported to the commissioners in lunacy, was 80,156, exclusive of 248 chancery lunatics, residing with their committees, and 81 insane convicts, — a gross increase during the year of only 452 patients. The number of registered lunatics in Scotland on the same date, apart from 62 persons in the lunatic department of the general prison at Perth, and 230 imbeciles in training-schools, who are registered separately, was 10,895, — an increase for the year of 268. The total number in Ireland was 14,415, — an increase of 136. This gives an aggregate of 105,466 insane (including some idiots with them) in public and private institutions for lunatics or establishments for paupers, or boarded out, and subject to governmental inspection; and the total increase in twelve months was 856.

## THE UPRIGHT POSITION IN MAN.

DR. GUY HINDSDALE of Philadelphia has carried out a suggestion of Dr. Weir Mitchell's to a very interesting conclusion (*Amer. journ. med. sc.*, April, 1887). The suggestion consisted in the desire to record accurately the swaying to and fro and from side to side which every one feels himself involuntarily making when trying to stand perfectly still. Placing the heels and toes together, with the hands hanging from the sides, the head erect, and the eyes directed to a fixed object, a silk thread was attached to the forehead, passed over a pulley, and was connected with a rod moving vertically and carrying an index. The index recorded on the smoked surface of a revolving drum. A fall of the line on the drum indicated a forward movement of the head, and an upward line a backward movement. The lateral movements of the head were similarly resolved into the downward and upward tracings of a second index. A third curve recorded the respiration, and a fourth marked seconds.

Another method of recording the sway consists in placing a flat piece of cardboard with a smoked surface upon the subject's head, and have him stand under an index free to move up and down in a fixed line. The resulting tracing shows the continuous movements which occurred. This method is coarser than the other, but has practical points of interest for clinical purposes to which it has already been applied.

Without exception, all persons, including the most healthy, swayed both forward and backward and from side to side. The first movement is generally the more extensive, and is, on the average, one inch, while the lateral sway averages about three-quarters of an inch in normal adults. The first movement is almost invariably forward, then a counterbalancing movement backward with a tendency towards the right. The rate of the movement shows a rhythmical tendency of about fourteen per minute, with a respiration of about twenty-two per minute. The significance of this rate has not yet been ascertained, and its constancy suffers many deviations.

An interesting observation is the common tendency of falling forwards and towards the *right*, which at once suggests all the problems of bilateral asymmetry. The suggestion is borne out by further trial; for, while right-handed people almost invariably are inclined to tilt over to the right, of twenty-two left-handed people, twelve inclined towards the left. This agrees well with the observations that the right arm is heavier and larger than the left, and thus brings the centre of gravity on the right side. That this is co-ordinated with an increased development of the left brain is well made out, and receives its final confirmation in the fact recorded by Flechsig, that more fibres cross over in the pyramidal decussation from the left brain to the right side than *vice versa*.

That the eyes are used to correct these swayings is well proved by the fact that, with the eyes closed, the sway is increased by about fifty per cent. So, also, absence of fixation of the eyes, reading aloud, removal of the shoes and stockings, materially increase the sway.

Children sway absolutely more than adults, and there is greater equality in their case between the antero-posterior and the lateral sway. Twenty-five girls showed an average lateral sway of 1.06 inches, and an antero-posterior sway of 1.08 inches, which was increased by about forty per cent when the eyes were closed.

Thirty-nine blind persons gave an average lateral deviation of 1.4 inches, and an antero-posterior deviation of 1.7 inches, which is about the same as that of seeing persons with closed eyes, thus suggesting that the years of experience have been of no avail in making the blind keep a truer equilibrium than seeing persons momentarily deprived of sight. In deaf-mutes the lateral sway was .93 of an inch, and the antero-posterior .85, which averages became 1.18 and 1.31 with closed eyes. All except two of these (all were right-handed) swayed towards the right. (Incidentally the observation of Professor James, that deaf-mutes are less liable to dizziness than normal persons, was confirmed.)

From the clinical side, it was found that ether exaggerates the normal sway considerably without introducing other peculiarities. In locomotor ataxia (characterized by unsteadiness and uncertainty of the gait) the sway with the eyes open in several cases was observed to vary from 2.25 to 3.75 inches on the antero-posterior line, and from 2.50 to 3.25 laterally. Six observations with the eyes shut show a lateral sway of from 3 to 6 inches, and an antero-posterior sway of from 3 to 7 inches. A case of spastic paralysis showed the deviations almost entirely in the antero-posterior line, while in chorea the difference between the deviations in the two directions is marked, and both are exaggerated (lateral, 1.45 inches; antero-posterior, 2.35 inches).

Dr. Hindsdale justly claims for these observations considerable suggestiveness for physiological research and direct clinical utility.

## FLORIDA GEOLOGICAL SURVEY.

FOR the first time in the history of the state, Florida has instituted a geological survey of its territory. The survey is not yet fully organized; but a preliminary report of thirty-one pages, on

the geological features of the state, has been prepared by Dr. J. Kost. Florida has never been a very promising geological field, the rocks being effectually concealed almost everywhere over its level surface by extensive quaternary and recent deposits; while the facilities for geological observation afforded by artificial excavation and river and coast erosion are very meagre. Enough facts, however, have already been determined to show that Florida can no longer be regarded as simply a long stretch of sand deposited on a series of coral reefs. Every member of the tertiary series has been identified in the state, and the lowest division or eocene, especially, is of considerable extent and thickness. A low anticlinal axis runs down the peninsula midway between the east and west coasts. This uplift appears to have occurred at the close of the eocene, since the later rocks differ in character on the two sides of the ridge. Those of the east side are chiefly the coquina or shell limestone; while those of the west side are coralline and shelly limestone, and sandstone, with much siliceous material. In most parts of the state, all the formations, and especially those newer than the eocene, are often exceedingly cavernous; branching channels, with running streams into which numerous sink-holes descend from the surface, constituting an extensive system of subterranean drainage. In numerous instances these subterranean streams reach the surface at lower levels, forming springs of great size and force. Under the head of geological principles, the physical and geographical features of the state in the successive epochs, and the sources of the different kinds of sediment, are discussed at some length. The sandy and seemingly barren soil of Florida is shown, by statements concerning its composition and agricultural products, to possess virtues not suspected by the casual observer. Not only is the soil much better than it has been represented, but it is shown that the state is not lacking in materials for improving it to any desired extent. Shell marl is abundant in all parts of the state, and the discovery of important phosphate deposits similar to those of South Carolina is announced. Aside from the marls and phosphates, the mineral resources of Florida are very limited, including, however, some building-stones and clay-beds, and indications of lignite and iron ore.

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MR. AND MRS. E. W. MORSE, pioneer members of the San Diego society of natural history, have recently presented that association with a lot near the post-office, valued at over twelve thousand dollars. By the conditions of the gift, the society will erect a building.

## *RELATION OF THE STATE TO INDUSTRIAL ACTION.*

PROFESSOR ADAMS has given us a pamphlet that is not only critical but constructive, and it is the ablest monograph that the Economic association has yet issued. It is not altogether new, for its substance was read some time ago as a paper before the Constitution club of New York City, and published by the club with the title "Principles that should control the interference of the state in industries." In its present form, however, the argument is both revised and extended.

The author's plan of procedure is simple and suggestive. He first takes up the *laissez-faire* theory, analyzes it, and finds it inadequate as a guide in constructive economics, and then develops his own principles for the regulation and limitation of state interference. Professor Adams finds himself unable to follow Mill's dictum that every departure from *laissez-faire*, unless required by some great good, is a certain evil. He finds the presumption against state activity an insufficient principle upon which to base constructive efforts. He, moreover, regards the modification of the English system of economics for which Professor Cairnes is largely responsible as no improvement. "In its original form, it [English economics] was conclusive as as argument though based upon an erroneous premise; in its modernized form the error of its premise has been corrected, but its conclusiveness as an argument has thereby been destroyed" (p. 25). As modified, the doctrine of *laissez-faire* cannot lay claim to scientific pretension, and amounts to nothing more than a declaration in favor of the wisdom of conservatism.

In seeking to replace this now discarded principle, Professor Adams finds some obstacles, owing to the general failure to distinguish clearly between *laissez-faire* as a dogma and free competition as a principle. "The former is a rule or maxim intended for the guidance of public administration; the latter is a convenient expression for bringing to mind certain conditions of industrial society" (p. 32). Over against the prevailing English maxim with its presumption in favor of the individual, on the one hand, and against the prevailing German maxim with its presumption in favor of the state, on the other, the author brings forward this principle, distinct from both, as the starting-point for constructive study: "It should be the purpose of all laws touching matters of business, to maintain the beneficent results of competitive action while guarding society from

*Relation of the state to industrial action.* By HENRY C. ADAMS. Baltimore, American economic association. 8°.

the evil consequences of unrestrained competition" (p. 35).

Unrestrained competition, Professor Adams argues, results in important evils of three sorts. First, it tends to bring the moral sentiment pervading any trade down to the level of that which characterizes the worst man who can maintain himself in it. Secondly, it renders it impossible for men to realize the benefits that arise, in certain lines of business, from organization in the form of a monopoly. Thirdly, the policy of restricting public powers within the narrowest possible limits tends to render government weak and inefficient; and a weak government, placed in the midst of a society controlled by the commercial spirit, will quickly become a corrupt government. In these three important respects *laissez-faire* fails. Therefore the principles for state interference which Professor Adams lays down are three, one corresponding to each of the above evils: 1°. The state may determine the plane of competitive action; 2°. The state may realize for society the benefits of monopoly; 3°. Social harmony may be restored by extending the duties of the state.

To use the author's own language, "This essay may be regarded as a plea for the old principle of personal responsibility as adequate to the solution of all social, political, and industrial questions; but it is at the same time urged that this principle must be accepted fearlessly, and applied without reserve. . . . [Monopolies], it is claimed, should be controlled by state authority, and it is suggested that the American theory of political liberty will lead men to rely as far as possible upon the efficiency of local governments in the exercise of such authority" (pp. 84, 85).

In some particulars we find ourselves obliged to differ with the author, both as to principles and as to applications; but his argument is clear and straightforward, and we bear cheerful testimony to its ability and its candor.

## GRASSES OF NORTH AMERICA.

IT has sometimes been urged, as an argument against the establishment of agricultural schools, that there were no adequate text-books in which the student might find, systematically arranged and classified, the knowledge of agricultural matters acquired by the farmer on the one hand, and the student on the other. There has been, too, a sufficiently large grain of truth in the accusation to cause us to welcome such additions to agricultural literature as Storer's 'Agriculture,' recently noticed in these columns, and Beal's 'Grasses of North America.' Both these books, in quite different ways and in quite distinct fields, go far to fill what were serious gaps, and the future student of agriculture will owe both authors a debt of thanks.

*Grasses of North America, for farmers and students.* By W. J. BEAL. Vol. i. Lansing, Thorp & Godfrey, pr. 8°.

Although written by a botanist, and informed throughout by botanical knowledge, 'The grasses of North America' is a book for the farmer rather than for the botanist. The chapters upon the structure, form, and development of the grasses, the power of motion in plants, plant growth, and on classification, while containing much valuable matter, are really preliminary to the succeeding chapters upon more immediately practical topics.

In these the author has collected the results and opinions of the leading authorities of this and other countries, and added much valuable original matter upon such topics as the adaptation of the various cultivated grasses to different purposes and different conditions of climate and culture, the preparation of the soil, the care of grasslands, making hay, etc. A chapter upon the insect enemies of grasses and clover, by Prof. H. J. Cook of the Michigan agricultural college, and one on the fungi of forage-plants, by Prof. William Trelease of the Shaw school of botany, St. Louis, conclude the book, which deserves a wide circulation among the farmers and students for whom its title designs it. It should be added that the abundance of excellent illustrations greatly adds to the value of the book. A second volume is in preparation, to contain the description of all known grasses of North America, with full notes on their value for cultivation.

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THE initial publication of the Henry Draper memorial is issued by Professor Pickering as the 'First annual report of the photographic study of stellar spectra, conducted at the Harvard college observatory.' With the Draper 11-inch photographic telescope, spectra have been obtained which we believe have not been equalled elsewhere; and Mrs. Draper has decided to send to Cambridge a 28-inch reflector and its mounting, and a 15-inch mirror, with which Dr. Draper's photographs of the moon were taken. But, what is more important, Mrs. Draper has not only provided the means for keeping these instruments actively employed, some of them during the whole of every clear night, but also of reducing the results by a considerable force of computers, and of publishing them in a suitable form.

— The tenth annual meeting of the American society of microscopists will be held in Pittsburgh, Penn., commencing Tuesday, Aug. 30. Prof. W. A. Rogers, Waterville, Me., is the president; and D. S. Kellicott, Buffalo, N.Y., secretary.

# SCIENCE.

FRIDAY, MAY 13, 1887.

## COMMENT AND CRITICISM.

PROFESSOR ADAMS'S recent monograph on 'The college of William and Mary,' published by the bureau of education, is a valuable contribution to the history of the higher education in the south. Founded in 1693 by royal grant, this college is the oldest in the south, and, with the exception of Harvard, the oldest in America. This venerable institution has fallen upon evil days. During the civil war, nearly all of its property was destroyed, and the greater part of its endowment was lost. The college which gave Washington his degree of civil engineer, and to which, as chancellor, he gave his last public service; the college where Jefferson, Monroe, Randolph, Marshall, and other early fathers of our republic, were educated, — is now closed. Of its former faculty, only President Ewell remains; and we are told that at the beginning of each academic year he rings the college-bell, as a reminder that the institution still lives. Repeated efforts have been made by friends north and south, notably by Senator Hoar, to have congress reimburse the college for the destruction of its property during the war, but without success.

While we can join in the wish that the good old college may again see prosperous days, and commend highly Professor Adams's diligent search for the facts in the history of such an institution, we cannot too strongly condemn his suggestion that a civil academy for instruction, at public cost, in higher political education, is one of the needs of the hour. The land is dotted now with colleges of higher or lower degree, in which any young man may obtain all the instruction necessary, if he but have the necessary grit. The formation of a national school of paid students is by no means necessary, that we should have a supply of capable civil servants. It may be well enough for the government to support those men who are willing to fit themselves for the army and navy, which training may unfit them for civil pursuits: we cannot have modern soldiers and sailors in any other way. But in civil life we are in sore need of men who can understand the homely proverbs of Poor Richard, and who will not be misled into joining any anti-poverty society. Such men can get a school-training which they will make tell, from any village school, and will not ask the government for alms that they may the later live from the public purse. While a good clerk might be turned out by such a civil academy, may we always be able to throw the real burdens of government on the shoulders of those who have learned to carry their own weight.

AT A RECENT MEETING of the Engineers' club of Philadelphia, Mr. Edwin Ludlow spoke of a much-needed invention to facilitate the preparation of anthracite coal without injury to health. While engineering ability and mechanical skill have done wonders during the last decade toward putting the mining and preparation of coal on a scientific basis, making it possible to ship as high as twenty-six hundred tons of prepared coal from one breaker in a single day, still in every breaker, no matter how modern it may be, one will find the chutes, through which the coal passes from the screens to the loading-pockets, lined with boys from twelve to fourteen years of age, who sit there ten hours a day, picking by hand the slate from the coal as it passes along. The atmosphere of this screen-room is, in many cases, so laden with fine coal-dust that objects cannot be distinguished twenty feet away; and, while the breathing of this coal-dust does not seem to have any immediate effect on the boys' health, it undoubtedly lays the seeds for the bane of the coal-region, — miners' consumption. It strikes every thoughtful man, who looks down on from one hundred to two hundred boys working in a single breaker, that it is a very crude and expensive way of preparing coal.

We learn from Mr. Ludlow that various appliances have been designed, but that the only really successful one, as proved by actual experience, has been the water-jig. This undoubtedly removes the slate with a small percentage of waste of coal; and where the product of the

mine is wet, and water has to be used on the screens to effect a separation of the dirt from the coal, it is the best and most economical appliance that can be employed. But the greater part of the coal going to market comes from dry mines, where it would be a detriment to the quality of the coal, and a great expense, to use water. The waste water from the jig is also expensive to take care of, as in most localities it is no longer allowable to let it run, with the fine dirt it holds in solution, into the nearest creek, as the sediment will carry a long distance, and deposits itself where it will do harm, and entail a suit for damages. Enough tanks have therefore to be provided to allow all the waste water to thoroughly settle, so that the water and culm can be removed separately. Water itself, or rather the pure article, is both scarce and expensive during a part of each year throughout nearly the whole region. And if mine water is used, as is generally the case, the acid contained in it attacks the iron work of the jig, and makes frequent repairs necessary.

The principle the jig works on is based on the difference in specific gravity between coal and slate. The two enter the bottom of the jig together, and, by the pulsations of a large plunger in an adjoining compartment, water is forced up through the coal, lifting it, and allowing a fresh supply to come in. The coal is forced to the top and runs off with the water, while the slate, owing to its greater specific gravity, passes out through a separate opening in the bottom. What is needed, in Mr. Ludlow's opinion, is a dry jig, in which this separation will be effected by the use of air instead of water. One of the difficulties encountered in getting up such a jig is caused by the care with which coal has to be handled to prevent its chipping or breaking. It cannot be dropped on iron, or wire, or itself, without producing an appreciable percentage of waste. With the most approved rolls, the loss in rebreaking any size to a smaller one amounts to from ten to fifteen per cent. While the difference in specific gravity between coal and slate of the same-sized pieces is very great, still trouble would be experienced in any separation by an air-current with flat pieces of both slate and coal, on which the action of the air would vary, according as it acted on the edge or the whole side. The man who invents a successful dry jig, that will stand the test of actual trial, will undoubtedly make a very handsome thing by it. Not to be too cumbersome, a single jig should not have a greater capacity than five hundred tons per day; and, as the shipping capacity of the anthracite region is about two hundred thousand tons per day, it would take about four hundred to supply the trade.

PROFESSOR VAUGHAN OF MICHIGAN UNIVERSITY has been engaged in the study of the chemistry of tyrotoxicon, the principle discovered by him in poisonous cheese, and which he believes to have been responsible for a number of cases of poison due to ice-cream. Professor Vaughan concludes from his studies that tyrotoxicon and diazobenzol are identical. To a large cat a small bit of diazobenzol nitrate was given, dissolved in water. In a few minutes the animal began retching, and in three-quarters of an hour it vomited freely, and later was purged. The stomach, when opened, was found to contain a frothy fluid, and its mucous membrane was blanched. Thus, not only were the symptoms identical with those of tyrotoxicon, but the post-mortem appearance was the same as that observed in cats poisoned with tyrotoxicon obtained from cheese, milk, and ice-cream. From some oysters which poisoned nearly seventy people in Michigan lately, Professor Vaughan obtained the tests for diazobenzol. The symptoms produced by the oysters were identical with those observed after eating poisonous cheese, ice-cream, and milk. It is altogether likely that the active agent in all those foods which when partly putrid produce the same group of symptoms, is diazobenzol, probably combined with different acids. Professor Vaughan is now experimenting with the hope of ascertaining the nature of the micro-organism which produces this poison, but is not yet ready to make any definite report. It seems to be a germ which develops best in the absence of air, or with only a limited supply of air.

WE ARE NOW APPROACHING the season when the attention of teachers and pupils alike is turned toward the important matter of examinations. Review-work is begun, and there is a general arranging and polishing-up of knowledge in anticipation of the annual test. Since examinations play so important a part in our educational institutions from primary school to college, it is fitting that they should be the subjects of special thought and attention. For this reason we print

this week the instructive paper of Mr. Carr, and shall follow it shortly with a discussion on the function and conduct of examinations, to be participated in by well-known educators. The formulation of some test of knowledge that will avoid in as large a measure as possible the evil practice of 'cramming' is what is wanted. In this matter perhaps the schools might take a leaf out of the experience of the universities, and make the passing or not of an examination depend largely upon some original work which shall involve the principles sought to be conveyed in the class-room instruction. The system of marking we believe to be unsound in theory, and vicious in practice; and to its operations we ascribe many of the ill effects now observed to follow from competitive examinations. But the subject is a large one, and we commend it to the careful thought of our readers.

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PROFESSOR JOWETT OF OXFORD, than whom no Englishman is better known for his interest and activity in educational matters, is a strenuous advocate of state aid to education; and that, too, not in the direction of elementary education alone, as is proposed in this country, but in the form of direct subventions to the so-called university colleges. Ten such colleges now exist in England, seven of them having been founded during the past decade. If two or three more are added, then provision will have been made for all the cities having over one hundred thousand inhabitants. The cost of the education in these colleges is about twelve pounds annually, — a sum not only greater than the students can afford to pay, but a good deal less than will suffice to keep the institutions in their present state of efficiency. "The financial prospect of these colleges," says Dr. Jowett, "is therefore the reverse of hopeful. It is practically impossible to support them by voluntary subscriptions. They do not appeal to the humane or religious feelings of mankind, like hospitals or churches; and there are many who think that the ambition of the poorer classes to have a better education ought not to be encouraged.". Dr. Jowett touches on the many and varied benefits conferred by these university colleges not only on the places in which they are situated, but on the country at large, and urges that the sum asked for from the state is not large, and that it would be given to those who have done all they can to help themselves, that it might be proportioned to subscriptions raised in the various localities, and that no new principle is involved. "No principle of political economy forbids the application of public money to the education of those who cannot afford to educate themselves. Such an expenditure is really one of the best affairs of business in which a nation can engage." There is some prospect, we understand, of Dr. Jowett's plea being effective, at least in some degree.

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AN INTERESTING ARTICLE on 'Realistic and dramatic methods in teaching geography,' by William Jolly, appears in the March and April numbers of the *Scottish geographical magazine*. The author urges that the mechanical method of teaching now in general use be abandoned, and that 'things should be taught, not words.' He thinks that in the initiatory stages the use of the text-book should be entirely dispensed with, and that all teaching should be based on the use of the map and of models. For showing the elementary features of the earth's surface, he would use models, — water poured on a table, to show the relations between land and water, and clay or sand to show the phenomena of relief. He would then proceed to explain the use of the map. We are of the opinion, that, as far as possible, the natural phenomena of the country should be made use of for illustrative purposes, as models frequently give rise to ideas as incorrect as those produced by mere description. Good pictures, even, might be found more serviceable than clay and sand. Mr. Jolly emphasizes the necessity of thoroughly teaching the use and meaning of maps as showing the geographical phenomena of a country, as well as the usefulness of illustrating these phenomena by means of pictures and collections from different countries. This method has been adopted in many schools of Germany and Switzerland. We notice in the latest issue of the Journal of the Aarau geographical-commercial society, that this system is being supported by the Swiss geographical society. The Aarau society has arranged a collection of photographs, products, etc., of different countries, and sends it to the schools of Switzerland by turns, for use in geographical instruction. The St. Gallen society has recently resolved to take part in this enterprise, and has arranged a similar collection for circulation in the schools of eastern Switzerland. The principal difficulty in teaching the use of the atlas, and of making it the basis of geographical instruction, is the lack of a uniform atlas. This question was discussed by

the German Geographentag on April 17. After a long discussion, it was decided that the use of different atlases in one class was detrimental to the success of the teaching of geography, it preventing a thorough explanation of the meaning of the map, the material contained in the maps being too different in different atlases.

THE REPORTS OF THE SONORA earthquake are still very incomplete. As far as can be seen from the meagre notes published in the daily papers, the Sierra Madre, which forms the boundary between the states of Sonora and Chihuahua, was the centre of activity. The towns and villages on the Rio de Batepito on its western side, and those on the Rio Corralitos on its eastern side, suffered most severely. In the former valley, reports of loss of property and life come from Oposura (Moctozuma) on the Rio de Soyopa and Babiose. There are, however, two places of that name, — one on the Rio de Batepito, one in the Sierra Madre. On the east side Corralitos and Cases Grandes suffered severely. As the district lies midway between the Sonora and Mexican railways, news travels slowly, and the reports are much retarded. The first shock occurred on May 3, and was followed by other violent tremors, the latest reported being on May 8. The accounts of volcanic eruptions are very doubtful, as it seems that the steam from hot-springs and the smoke of forest-fires have been mistaken for eruptions. There are three lines of volcanoes in this district, — the New Mexican line of extinct volcanoes; the line of California, which meets the former at the head of the Gulf of California; and the Mexican line, which runs from Orizaba to the Revilla Gigedo Islands. It contains several active volcanoes. There are no signs of disturbances of any of these volcanoes during the earthquake, while one report refers to an eruption near the boundary of Guatemala. The shocks were felt in southern Arizona, New Mexico, and Texas, but not so strongly as in Sonora.

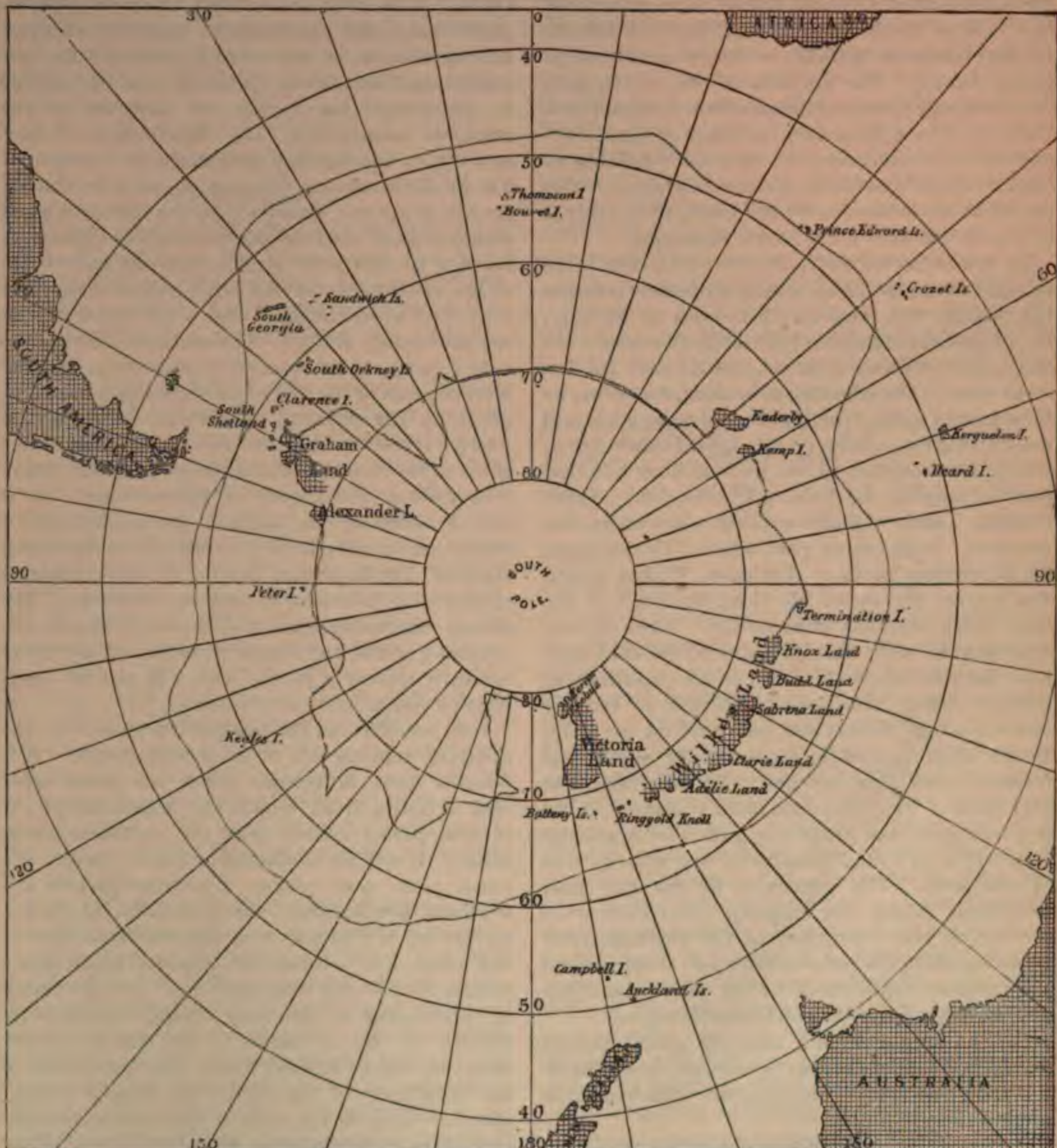
## *THE EXPLORATION OF THE ANTARCTIC REGIONS.*

DURING a period when explorations were most vigorously carried on in all other parts of the world, the antarctic region remained as unknown as it had been for a long time. Since Cook, by his voyages, had proved the non-existence of an extensive Terra Australis, which former geographers supposed to occupy a great part of the southern hemisphere, nothing worth mentioning was done until the beginning of the present century. After peace had returned to Europe, which had been shaken by revolutions and wars, polar explorations were resumed: Parry, Ross, Lyon, Scoresby, and Franklin enlarged our knowledge of the arctic regions; while Bellingshausen, Biscoe, Balleny, Wilkes, Dumont D'Urville, and James Ross explored the antarctic seas. But this period of lively activity in the southern hemisphere did not extend over more than twenty-five years, from 1819 to 1843. After that time the enthusiasm for arctic travel reached its highest pitch in the numerous attempts to rescue Franklin or to ascertain the fate of his unfortunate expedition; but the antarctic seas have never been visited again, and our knowledge has not been increased since the period mentioned.

It was not until quite recently that new efforts were made to revive the interest in antarctic exploration. Maury tried to organize an expedition, but it was in vain: he was unable to find any support, either in England or in America. The revival of interest is chiefly due to the efforts of G. Neumayer of Hamburg, whose frequent and energetic appeals had the effect of arousing many societies from their inactivity, and of awakening a new interest in the problems of antarctic geography. It was in 1861, when Neumayer was director of the observatory of Melbourne, that he tried to work for renewed explorations in those regions. Since that time he has continued to do so with unabating perseverance, and his frequent addresses and writings on the subject have principally created the present interest in antarctic exploration. In 1885 the German Geographentag discussed the subject very fully, and expressed itself in favor of renewed explorations in the antarctic regions. In the same year Admiral E. Ommanney brought the matter before the geographical section of the British association, and a committee was appointed, which reported favorably on the matter. This example was followed by the Scottish geographical society and the Royal society of Edinburgh. Later on, the Royal society of Victoria discussed the subject, and issued a report, in which they express the willingness of the Australasian colonies to render assistance to an imperial expedition if decided on, and the intention of the committee, meantime, to arrange for the despatch to the antarctic regions of a steam-whaler, with a small staff of observers, for the purpose of discovering some safe winter harbor for the projected expedition. The latest news is that Nordenskjöld proposes an expedition which is to last eighteen months.

At this moment, when we may hope that the

exploration of the antarctic regions will be resumed, it will be of interest to review the history of former expeditions. Cook had expressed the opinion that it was impossible to approach the land which he supposed to exist around the pole, sent out Captain Bellingshausen, who discovered Alexander Island and the isolated Peter Island. The results of his explorations, which were published at St. Petersburg in 1831, did not become known until some years later, as frequently is the




MAP OF ANTARCTIC REGIONS SHOWING THE LIMITS OF OUR KNOWLEDGE.

on account of the heavy masses of ice met with. It was his opinion that these could originate only on an extensive land. Almost half a century had passed, and no new attempt had been made to continue his explorations, when Nicolaus I. of Russia case with books written in Russian. He was followed by Weddell in 1822, who, on a sealing voyage south-east of South Shetland Islands, reached latitude 74° 15′ south, where he found the sea free from ice, navigable, and abounding with whales

and birds. For ten years we do not hear of any further attempts. Then one Mr. Enderby of London fitted out several vessels, and sent them to the Antarctic Ocean for sealing and exploring purposes. The first expedition, in 1830, was under command of Captain Biscoe, who discovered the coast of Graham Land and Enderby Island. He was followed by Kemp in 1834, who discovered Kemp Island. The problem of the south pole then suddenly attracted the attention of all nations. Balleny, who commanded another of Enderby's expeditions, discovered in 1839 the volcanoes of Balleny Island and Clarie and Sabrina Land, — two points of the extensive Wilkes Land, the existence of which was later on so much contested.

In the following year, Dumont d'Urville came in sight of Adélie Land, which is situated between the eastern and western discoveries of Balleny. He estimated the height of the land to be about 3,500 feet. It is covered with ice, and no bare patches were seen. On effecting a landing, however, he found some rocks, which proved it to be land, and not drifting ice. Later on, he sighted Clarie Land, which he describes as an ice wall four hundred feet in height. In 1838, d'Urville had visited Graham Land, without making noteworthy discoveries. In the same year, when d'Urville made his discoveries south of Australia, Wilkes visited that region, and sailed all along the coast of the land which bears his name to-day. As he did not approach it very closely, some of his land may have been drifting ice. Ross, on his expedition of 1840–45, sailed over the place east of Balleny Islands, where Wilkes had put land on his map. In 1842 Ross reached latitude 78° 10′ south, the farthest point ever reached. He discovered the highlands of Victoria Land, with volcanoes 12,000 feet in height, and sailed along the formidable ice wall which he found attached to the eastern side of this land. His voyage is by far the most prominent among the antarctic expeditions, on account of the experience of the commander in ice navigation, his perseverance and boldness, and the valuable observations on the physical geography and topography of the antarctic regions.

On the accompanying map the most southern points reached by these explorers are connected by a broken line which includes the unknown area around the south pole.

Except the short journeys of Moore in 1845, and Nares in 1874, no further attempts to penetrate into the Antarctic Ocean have been made. It seems that the singularity of phenomena presented in the antarctic regions did not excite as much interest as did those of regions the borders of which were known. Here the fragmentary state of our knowledge was brought to mind whenever vague news of the unknown parts reached us, while no reports from the icy south pole kept up the faint interest it may have attracted at one time.

The geographical problems of this part of the world, nevertheless, are of the greatest importance. It is well known that the polar regions, particularly the south polar region, regulates the circulation of the oceans, and that its currents must be studied before it will be possible to understand thoroughly the currents of the southern hemisphere. The distribution of land and water, the depth of the ocean, the amount of ice, its thickness and distribution, must be studied for this purpose. Besides this, the meteorological phenomena of the southern hemisphere depend on those of the antarctic region, and our knowledge of the meteorology of the earth will be incomplete until such phenomena of the south polar region are thoroughly studied. The southern hemisphere is to a great extent covered by the ocean, and the land consists of narrow strips which have no great effect on the physical phenomena of the atmosphere: therefore they are not so complicated as those of the northern hemisphere, and their study will further the theory of meteorology. It is hardly necessary to mention the importance of researches on terrestrial magnetism in the antarctic regions. The important bearing of these problems on practical questions cannot be overrated. The seaman cannot dispense with the knowledge of the currents, winds, and magnetic elements, and there is hardly a class of people who will not be benefited by the progress of meteorology.

But, besides this, the scientific problems of the antarctic regions are of great importance. It is possible that in former times the arctic zone was a centre from which the organisms of the present period spread over the northern hemisphere. It will be important to know whether the south polar zone played a similar part in the southern hemisphere. The formation of the antarctic ice is probably very different from that of the arctic ice, because the summer temperature seldom rises to the freezing-point. The glaciation of this region is extremely extensive, and its influence on the formation of the surface of the land can best be studied there. Our knowledge of the geography of the earth will remain a fragment so long as an area of this extent remains unknown, particularly as the physical geography of the southern hemisphere depends to a great extent on that of this region. From this stand-point, the resumption of antarctic explorations is even more important than the continuation of arctic expeditions. Fortunately the chances of success are very good, as the Antarctic Ocean seems to be far more navigable than the arctic seas. The ice

is not obstructed by land, and therefore spreads more readily, leaving open water for the ships to pass through. Whalers and sealers are carrying on a successful hunt in the Antarctic Ocean, and undoubtedly an expedition would open new grounds to them. It is to be hoped that the interest in antarctic exploration which manifests itself in all parts of the world will lead to a new period of discoveries in the ice-bound seas of the south pole.

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## *HEALTH MATTERS.*

### *Distillery milk.*

THE raid made by the officers of the New York board of health, on the cow-owners who bring milk to the city from animals fed on distillery swill, has awakened a new interest in this subject, which *Science* has discussed for the past two weeks.

For the benefit of those who are not informed, it may be well to explain what distillery swill is, and why it is regarded as objectionable food for milch-cows. In the manufacture of whiskey from rye, wheat, or Indian-corn, the ground grain, together with malt, is placed in a tub with hot water. The diastase present in the malt, acting as a ferment on the starch of the grain, changes it into glucose. After cooling, yeast is added, and fermentation takes place, resulting in the conversion of the glucose into alcohol and carbonic acid. The contents of the tub are then placed in a still and the alcohol is distilled off. The refuse is distillery waste or swill. In the above process, most of the starch has been changed into glucose. The swill contains a small amount of starch, together with cellulose, gluten, and some dextrine. The quantity of water in swill is very large, varying from seventy-five to ninety-five per cent.

It will be seen from the above statement, that, in order to get a sufficient amount of nutriment, a cow feeding on distillery swill must take into the stomach a very large amount of this waste, so large a proportion being water, and that in so doing the amount of carbohydrates taken is entirely inadequate to the demands of the system; and this want must, of necessity, result in a deterioration of the animal's health, and indirectly of the milk which it produces. It is an unnatural food for cows, as is shown by their dislike of it when first it is given them. In fact, in order to make them eat it, they must first be starved. Hassal quotes Harley as saying that "brewers' and distillers' grains and distillers' waste make the cattle 'grain-sick,' as it is termed, and prove injurious to the stomach of an animal. It has been ascertained, that, if cows are fed upon these grains, etc., their constitutions become quickly destroyed."

The effect of taking so large a quantity of fluid by the animal is to increase the quantity of the milk-secretion and at the same time to cause diarrhoea. We have stated that the quality of the milk produced from cows fed on distillery swill is very inferior. In support of this statement, we quote some analyses made by Dr. E. H. Bartley, chief chemist of the Brooklyn board of health. In a report made by him he says, "The effect upon the composition of the milk, of feeding cows on distillery or vinegar swill, is shown by the following analysis of three samples of swill-milk recently made by me, as compared with normal milk of cows fed on ordinary food:—

| | First. | Second. | Third. | Average of 300 analyses of normal milk. |
|---|---|---|---|---|
| Specific gravity | 1,03C.50 | 1,030.10 | 1,031.60 | 1,031.00 |
| Water........... | 89.46 | 88.68 | 87.56 | 87.41 |
| Solids........... | 10.54 | 11.32 | 12.34 | 12.59 |
| Fat.............. | 2.03 | 3.02 | 2.55 | 3.66 |
| Sugar........... | 2.83 | 2.74 | 4.11 | 4.82 |
| Caseine and ash | 5.78 | 5.66 | 5.68 | 4.46 |

It will be seen from these analyses that the fat and sugar are both deficient in the milk of the cow fed on distillery swill, while the caseine is increased. This is just what would be expected from the character of the food. When it is remembered that human milk contains more sugar and fat than normal cow's-milk and much less caseine, we can readily understand what the effect of such milk must be upon small children fed upon it. The amount of caseine being great, the curd of the milk is increased and the digestion made more difficult. When such milk is rendered slightly acid, or is allowed to coagulate spontaneously, a marked difference is noticed in the character of the curd formed, from that produced in normal milk. In the former the curd is tough and hard, and shakes to pieces with greater difficulty; so much so, that I have been able in a few cases to identify swill-milk by this property of the curd. In order to make such a milk agree in composition, even roughly, with human milk, one and one-half quarts of water must be added to one quart of milk, and then cream and sugar added to supply these ingredients; for, after the water has been added to dilute the caseine, the mixture would contain about one-fifth the necessary quantity of sugar, and about one-fourth the

necessary fat, to say nothing of the normal inorganic salts. It must be remembered that those milkmen who keep cows have a large demand for 'one cow's milk' to supply food for small children, and consequently this milk is more likely to be given to children than to adults, with all the evil consequences which must follow. This fact makes it imperative that such milk should be strictly kept from the market."

In support of the statement which we have made, that distillery milk is injurious, the following history is given. In August, 1882, a child four months old died in Brooklyn. At the autopsy the stomach was found to contain coagulated milk and a firm lump over three inches in diameter. The stomach was reddened. The intestines contained a pale slimy material characteristic of inflammation. Its membrane was studded with enlarged glands. In the opinion of the pathologist who made the autopsy, Dr. Leuf, death was due to exhaustion, — a result of gastro-enterocolitis, augmented by the presence in the stomach of the firm clot of coagulated milk, which was too firm for the child to vomit up or pass down into the gut, and therefore acted as a foreign body and irritant. The mother said the child was fed on 'one cow's milk.' Dr. Bartley analyzed the milk, and found it to be 'swill' milk. Its analysis was, water, 89.46; fat, 2.03; sugar, 2.83; caseine and salts, 5.74

In commenting on the above fatal result, Dr. Bartley says, "Swill-milk does not coagulate as readily as ordinary milk, but the curd formed is much firmer and less easily disintegrated in the former than in the latter. In most cases the flavor of the swill can be tasted in the milk after it has stood some hours in a corked bottle." Dr. Bartley, as a result of his study of the subject, says in regard to the feeding of swill to cows, "It is a practice which we cannot condemn too strongly, a practice which undoubtedly adds largely to the digestive troubles of infancy and childhood, and especially to the cases of cholera infantum so called, in the summer months."

In the first annual report of the New York state dairy commissioner, E. W. Martin, chemist, says, "Various kinds of unhealthy foods will produce milk not only abnormal in the proportions of its constituents, but in its reactions; and such milk must be considered unhealthy, although produced by an apparently healthy animal: as, for instance, the use of distillery swill."

In connection with this subject, it may be of interest to consider for a moment the mortality among infants, and its principal factor. In five months from June 1, 1884, 259 children under five years of age died in New Haven, of which number, 111 were from diarrhoea. The particulars of thirteen cases were not ascertained; but of the 98 cases whose histories were obtained, 14.3 per cent were children nursed by their mothers; 77.5 per cent were bottle-fed wholly or in part from the time they were two months old; 8.2 per cent were children who were longer nursed than the others, but were bottle-fed at the time they were taken sick. Published statistics seem to show that a large majority of those who die in infancy are fed by hand, that is to say, on cow's-milk. In countries where the death-rate under one year of age is least (under 15 per cent in Norway, Sweden, and Ireland), the practice of hand-feeding is almost unknown; while, on the other hand, where hand-feeding is the rule, as in Lower Bavaria and the Palatinate, 50 per cent of the children die before reaching the age of one year. From this view of the subject, the importance of the purity of the milk-supply cannot be exaggerated, and all public-minded citizens can do good service by fostering a public opinion which will sustain boards of health in their efforts to suppress traffic in swill-milk.

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Aniline treatment of consumption. — A new treatment of consumption has been proposed by Professor Kremianski of Russia. It having been demonstrated that the most dilute solutions of aniline were fatal to the tubercle bacillus, Kremianski suggested that aniline might be inhaled so that it would enter the circulation and also come in contact with the diseased pulmonary tissue, and destroy the bacilli wherever they might be. As a result, the cavities in the lungs would be converted into healthy granulating ulcers which might be expected to cicatrize. The Russian commission which was appointed to investigate the claims of this new method of treatment has experimented on a number of animals, which were fatally affected by small doses of aniline. The commission has concluded that aniline is not harmless to animal life, but, on the contrary, very poisonous indeed, and that it also exerts no beneficial effect on phthisis. Dr. Nesteroff tried this treatment upon a consumptive, with the result that he became rapidly worse, and died in a fortnight. It is more than probable, that, after this report, the aniline treatment will be abandoned.

Scarlet-fever-infected milk. — The health officer of Edinburgh has recently submitted a report of the facts connected with an epidemic of scarlet-fever in that city. His inquiry was with special reference to the connection between this outbreak and the milk-supply, and has resulted in showing that the affected district was supplied

from a source which was contaminated shortly before the commencement of the epidemic. The farm where the disease existed was daily sending to the city one hundred and twenty gallons of infected milk. This subject has been considerably discussed in Edinburgh recently, and a letter from a physician which appeared in the daily press, recommending that all milk should be boiled five minutes, has resulted in the general adoption of the suggestion throughout the city. Scarlet-fever appears to be very prevalent in Edinburgh, there having been at one time one hundred and ninety-nine patients in the city fever-hospital.

YELLOW-FEVER INOCULATON. — Dr. Urricoechea, surgeon of a battalion in Colombia, inoculated five of his soldiers for the prevention of yellow-fever. Twenty minutes after the operation the temperature gradually ascended to 40° C., accompanied with all the symptoms of yellow-fever. This lasted forty hours, at the expiration of which the fever and all attendant symptoms had disappeared. At the present time the inoculated soldiers are exposed to the infection. Dr. Bustamente, a physician of Cucuta, Colombia, reports that he has inoculated forty persons, and in many of them a fever, with many of the characteristics of yellow-fever, has presented itself; this fever, developed by inoculation, varying several tenths of a degree, and in some cases ascending to 41° C., but never presenting the most grave symptoms of yellow-fever. Dr. Bustamente says that the result of his observations justifies him in stating positively that the fever produced by inoculation is attended with no danger, and that it is safe to inoculate, as he has already done, persons from the age of two years upwards. Many of the persons inoculated by him have been exposed to yellow-fever, and in no case has the fever attacked them.

GELATINE LIQUEFACTION BY BACTERIA. — Dr. Sternberg has been studying the liquefaction of gelatine by bacteria, and has ascertained that it is due to a soluble chemical product which is formed during the active growth of the liquefying organisms, and that a comparatively small amount of this substance will liquefy gelatine quite independently of the living organism. Dr. Sternberg expresses the hope that some chemist will take up the question with a view to ascertaining the exact nature of this substance.

WATER-FILTRATION. — A very interesting series of experiments in the filtration of water has recently been made by Dr. G. T. Swarts, and reported by him to the Rhode Island medical society. He finds that, when first used, some filters successfully remove some of the organisms which the water contains, but that tests made seventeen days later showed in every instance a marked increase in the number in the filtered as compared with the unfiltered water. In one case the unfiltered water contained thirty-six colonies, and after passing through the filter there were 2,000; in another case the number was 10,000. An examination made on the seventieth day showed the number of colonies increased to 117,000. The explanation of these results is, that, in passing through the filter, some of the micro-organisms present in the water are retained in the filter, and at the same time some of the albuminoids which are present are also retained. These latter serve as pabulum for the micro-organisms, and the latter increase enormously under these favorable conditions, and water subsequently passing through the filter takes them up in large numbers. With every possible precaution in sterilizing and cleansing the filter, the number of organisms in filtered water exceeded those in unfiltered by several thousands; especially is this marked if the filter is in a warm room or in proximity to a hot-water pipe. While the bacteria ordinarily found in water are harmless, still it is possible that those of cholera or typhoid-fever might be present in drinking-water; and the practical application of these observations of Dr. Swarts is, that such germs would not only not be filtered out in the process of filtration, but that their number would probably increase many times in the filter itself. The filtration of water is therefore of no use when the presence of pathogenic organisms is suspected; and recourse should, under such circumstances, be had to boiling, it having been adundantly demonstrated that all organisms in water are destroyed at the boiling-point, if that temperature is maintained for one hour.

## *THE HUMAN FACULTIES.*

### *Mind and muscle.*

THE full significance of the modern view of the relation of body to mind is well brought home by the success of a recent experiment upon a dozen dull, sluggish, shiftless, illiterate inmates of the Elmira reformatory. The men were not exactly feeble-minded, but were dull and stupid, had made no progress in school-work, and seemed incapable of a prolonged mental effort. The class was formed on June 5 of 1886, when the men were, on the average, 22.9 years old; they had been committed for rather low orders of crimes, for which the law would have imposed an average sentence of about seven years; had one and all never learned a trade; and exhibited the usual amount of intemperance, hereditary taint, and lack of moral

development, which can be plainly read on the typical physiognomy of a criminal. Their average weight was 134 pounds; their height, 5 feet 4½ inches; and chest-girth, 32¾ inches. They were subjected to a carefully selected and weighed diet, to water and vapor baths, to kneading and massage; underwent a systematized training in dumb-bell and other gymnastic exercises; were drilled in keeping step and marching; and altogether lived (outside of the usual shop-work) very much the life of an athlete under training. As was to be expected, the first effect was a decrease in weight (of 4.37 pounds on July 1); but on Nov. 6, when the class discontinued, the average increase of weight was 1.23 pounds. Their muscles, previously soft and flabby, were now hardened and active; their shuffling gait was abandoned for an elastic walk; the dull and stolid look gave way to a brighter and more intelligent expression. But a special object was to see the effect of all this on their mental capabilities. When they began, one could neither read nor write; a second could barely do so; four understood long-division, but not well enough to get a correct answer; while the rest were wrecked before finishing simple division. Their average work in the school register prior to this experiment was 45.25 out of a possible 100; during the five months of training it was 74.16. Add to this the statement of the instructors, that the numbers fail to express the real improvement which their actions and spirit portrayed, and one appreciates the real success of this valuable experiment. Of course, the dullards were not made scholars, and to mentally awaken men of 23 is a different task from arousing a growing boy; but it shows that even in this low type of humanity there is a latent mental power capable of being acted upon for the good of its owner.

The rationale of this process, modern physiology can well explain. The muscles are connected by nerves with motor centres in the brain: they are the organ of the will, because their contraction is under the control of the brain-centres. When we exercise a muscle, we not only make it grow and develop, but we also strengthen the brain-centre that controls it. The language of the muscles appeals to the very root of human nature: the first step in educating idiots is to get them to move their limbs in an orderly way and at command, to educate their motor centres. Just so the dull brains of these criminally inclined men can be best aroused by arousing their motor centres. This effects a more vigorous vitality of the whole brain, and is the first step towards a higher psychic life.

Dr. Wey, to whom the credit of this painstaking work belongs, appends to his story separate photographs and a composite (unfortunately a poor one) of the group which will bear out the description of the men above outlined.

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TRAITS OF CRIMINALS. — An Italian scientist, Marro, finds that criminals are more apt than normal people to be the descendants of very young and of very old parents in opposition to parents of middle age; and the same is true of the insane. In a table founded on 1,865 normal men, 456 criminals, and 100 insane, 8.8 per cent of normal men were born of parents in the growing period of life, 66.1 per cent of parents in the period of maturity, and 24.9 per cent of parents who had already reached the declining period of life. Similar percentages for criminals are 10.9, 56.7, and 32.2; and for the insane, 17.0, 47.0, and 36.0. The same writer also finds that the bodily temperature of criminals is slightly higher than that of normal persons, being about 37°.07 C. in thirty cases which he examined.

THE WRITING AND PRINTING OF THE DERANGED. — The manuscripts of neuropaths — a word wide enough to include the slight and the severe disturbances of mental sanity — present certain typical characteristics. They abound in italicized words; in exclamation-points and punctuations after almost every word; in frequent use of capitals; in various sizes of writing, particularly much very large writing; and the like. It is not often that such people have the opportunity of going to print and converting the compositor to their peculiar system of typography. M. Richet prints a few specimen pages of such an author, and counts twelve different kinds of letters in seventeen lines, besides the usual capitals, exclamation-points, and so on, in great abundance. All this is significant of an excited, prancing state of mind, closely allied to delirium and mania.

COLORED SOUNDS. — Mr. Galton, in his 'Inquiries into human faculty,' has collected a number of very interesting and strange cases of persons to whom certain sounds always call up certain colors. In one case a whole language was developed for translating colors into sound and back again, and this favored individual could read words out of a wall-paper pattern, or paint a pattern to order to represent a word. Two French writers, Lauret and Duchaussoy, recently describe a case the peculiarity of which is its hereditary character. The gentleman in question has colors for articulated sounds, but not for musical ones. Both his son and daughter have a similar faculty. The father and daughter agree quite closely on the colors going with the vowel and consonant sounds; but the names of the numerals

are quite exceptional. While words seemed colored to them only when spoken very slowly and separately, and then simply take on the colors of the component sounds, particularly the vowels, the names of the numerals have distinct colors which are entirely different in father and daughter. Intense thought of a sound can bring up the color just as really hearing it does.

## EXPLORATION AND TRAVEL.

### Stanley's march.

ADVICES from Bansa-Manteka (about midway between Banana and Stanley Pool), dated March 29, say, "Mr. Henry M. Stanley, with his expedition for the relief of Emin Bey, has arrived here. All the members of the party are well. Mr. Stanley has decided to take a route by way of Stanley Falls for Emin's camp at Wadelai. He will restore the authority of the International association at Stanley Falls, install Tippo-Tip, and afterward ascend the Mbaru, which is now known to be for a great part navigable. At the point where navigation ceases, the caravan will start across the country, striking the Albert Nyansa at Murswur, where Stanley intends to form a fortified camp, and then send in advance boats to inform Emin of the arrival of the expedition, and solicit transportation to Wadelai by Emin's two steamers. The caravan, which presents an imposing spectacle, is about to leave here for Leopoldville. Four bodies consisting of twenty-five men each, commanded by Europeans, will go in advance to drive off the marauders infesting the route. The association's steamer the Stanley, the Livingstone mission steamer Henry Read, and the trading steamer Florida, will wait at Leopoldville to carry the expedition to the upper Kongo. The enterprise has caused a sensation among the natives. Many men from the factories at Banana and Boma are flocking to join the expedition, news having spread of the return of the 'white prophet' who will restore order among the people."

This report confirms the views expressed in some letters on the state of affairs on the Kongo, published by the Paris geographical society, to which we referred in *Science* of April 1, saying that the intercourse on both banks of the Kongo as far as Stanley Pool was interrupted by the natives attacking the caravans. Slow though the progress be, we may hope, however, that the Kongo association will succeed, after all, in opening central Africa to commerce. Even the bitterest enemy of the association cannot deny that great progress has been made since the first steps of opening the Kongo route were taken. Though the aspect is not so glowing as the association represents, we are confident of the final success of the numerous efforts for gaining a foothold in the Kongo basin.

Stanley's route leads through one of the most unknown parts of Africa, the exploration of which will lead to the discovery of the watershed between the upper Kongo and the Mvutan Nsige.

## NOTES AND NEWS.

THE Congress of German teachers, to be held at Gotha during the latter part of this month, will discuss the following questions: 1. In what respects can the school contribute to the solution of the social question? 2. Is the standard of morality among the masses higher than formerly, and, if so, how much of the credit of this is due to schools? 3. What external circumstances have a beneficial, and what have a detrimental, effect upon the work of the teacher? 4. How can history be used as a means of forming character? 5. The teacher as educator. 6. Is the continuance of public examinations desirable or not? 7. The educational value of singing. 8. The regular hygienic inspection of the school by a physician. 9. Educational walks with the pupils as object-lessons. 10. Instruction and reading books on the principle of the *Realschule*. 11. Discipline the *sine quâ non* of school-education. 12. Refuges for boys and girls. 13. Reformatory education. 14. The education of girls. 15. The need for a general simplification in the present spelling. 16. The exercise of the franchise by the teacher, both at general and municipal elections, is of the highest importance.

— The schools of Vienna are henceforth to give instruction in civics as part of the regular elementary teaching. This step is taken in accordance with a municipal decree.

— The prize of 25,000 francs, offered by the King of the Belgians for the best essay on the best means of improving the study and the teaching of geography, has been awarded to Anton Staubers, professor at the gymnasium at Augsburg.

— Sir Henry Sumner Maine, well known as the author of 'Early history of institutions,' 'Ancient law,' and 'Popular government,' has been chosen Whewell professor of international law at the University of Cambridge, in succession to Sir William Vernon Harcourt, resigned.

— Lord Rosebery is to be the Liberal candidate for the lord-rectorship of Glasgow university at the next election.

— Vienna university has now 6,135 students on its books.

— Harvard's two hundred and fiftieth anniversary and Columbia's one hundredth seem insignificant when we read that the University of Bologna will next spring celebrate the eight hundredth anniversary of its supposed foundation, the exact date of which is not known.

— M. Bernard Perey, whose books on infant and child psychology have been so successful, is at work on another of the same character, entitled 'La petite fille.'

— The University of Utrecht has now 37 professors, — theology, 4; law, 7; medicine, 9; science, 10; letters, 7, — 7 lecturers, and 5 privat-docents. 541 students are attending the university.

— After a heavy shower in Washington last week, the gutters and low places were covered with a deposit of fine yellow powder. Professor Ward pronounced it vegetable pollen, which came from the pine-trees of the district. It was very light, and was carried into the upper regions and washed out by rain. Professor Ward said, "It is the male element of the pine-trees, which usually shed their pollen at this season. It consists of minute grains, like little spores, and to the naked eye looks like yellow dust, but, subjected to the microscope, the grains have different shapes, which differ with the varieties of pine. It is common wherever pine-trees exist."

— The U. S. geological survey will collect all attainable information regarding the recent earthquakes in Arizona. Circular letters of inquiry will be sent to residents on the area affected, as usual. The disturbed area seems to be a circle of some four hundred miles radius, fully one-quarter as large as the Charleston earthquake, and nearly one-third of the area of the Riviera earthquake of last February.

— Dr. Sternberg left, May 3, for Rio de Janeiro, to investigate yellow-fever. He expects to return in September.

— Houghton, Mifflin & Co. have just published, in the 'American commonwealths' series, Prof. Alexander Johnston's history of Connecticut. Lee & Shepard have in preparation new editions of 'Milch cows and dairy farming' and 'Grasses and forage-plants,' by C. L. Flint of the Massachusetts state board of agriculture. Both are being carefully revised, and brought down to date.

— Sir Austen Henry Layard is now preparing for the press his early adventures in Persia, Susiana, and Babylonia, which will include an account of his residence among the Bakhtiyari and other wild tribes before the discovery of Nineveh. It will be published by Mr. John Murray.

## *LETTERS TO THE EDITOR.*

****The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Osteological notes.

IN *Science* for April 15, Mr. F. A. Lucas takes very courteous notice of my observations upon the rudimentary metacarpals of Bison bonasus (the auroch). As I remarked therein, the data were altogether too fragmentary upon which to draw conclusions. Still, it would seem, so far as my observations go, that the American bison exhibits only one rudimentary metacarpal, and that one invariably the fifth; while the European bison, according to Owen, develops both second and fifth. The skeleton in the Museum of comparative zoölogy presents only one, the second, without a trace of an articulating facet for the fifth.

I have again carefully examined the eight disarticulated and the two mounted skeletons of the Bison americanus in this museum, and in not one do I find a trace of an articulating facet for the second metacarpal. In Bos taurus the same is true, with the exception that occasionally, in place of the second metacarpal, there is present a very rudimentary stylet completely anchylosed to the cannon bone, and appearing as an exostosis. It could not be termed in any sense a rudimentary metacarpal.

Mr. Lucas says that an examination of four or five of the skeletons of Bison americanus, with which the U.S. national museum has lately provided itself, shows that in every case, rudiments of the second and fifth metacarpals are present, and that, as they are all *in situ*, there can be no mistake in the matter.

Possibly Mr. Lucas and myself differ as to what constitutes a rudimentary metacarpal; and I maintain that a distinct metacarpal, however rudimentary, requires the presence of an arthrodial facet upon the corresponding surface of the cannon bone. Nor do I believe, that, once such facet is developed, it ever disappears.

I can find no authority, except Owen on Bison bonasus, that speaks of the Bovinae as having more than one rudimentary metacarpal, and that the fifth.

If, as Mr. Lucas says, "there exists on the mounted skeleton of Bison americanus in the U.S. national museum a well-defined *articular facet* for the *second* right metacarpal," I yield.

At present my personal observation allows me to make the following deductions: —

1. That Bison americanus exhibits only a single rudimentary metacarpal, and that invariably the fifth.

2. That Bison bonasus may exhibit one or both rudimentary metacarpals; if only one, that this may be either the second or fifth. D. D. SLADE.

Cambridge, April 19.

With Dr. Slade's permission, I will add a few lines to his polite rejoinder to my note of April 15, he having kindly permitted me to read it before publication.

I fear I must indeed differ with Dr. Slade as to what constitutes a rudimentary metacarpal, holding that a bone, be it never so small, if constantly found

occupying the position of a metacarpal, must be considered as its degenerate representative, even if not articulating with the carpus or metacarpus by means of an arthrodial facet. This assumption would seem to be borne out by such cases as those of the telemetacarpal deer, in which the distal portions alone of the second and fifth metacarpals are present, and there is no articulation whatever with the cannon bone.

Would it not also be equally correct to deny the right of the 'spurious hoofs' in bison to be called phalanges because they have no connection whatever with the metacarpals?

Now, in Bison americanus there is in every 'rough skeleton' examined a bone about ten millimetres in length, occupying the place of the second metacarpal. Although this bone very rarely exhibits the slightest trace of an arthrodial facet, it is nevertheless, from my stand-point, to be considered as a rudimentary metacarpal. If not a metacarpal, what is it? In two skeletons out of six, there is a small facet on one leg only, but the little bone above mentioned is the bony core of a symmetrically shaped cartilaginous mass very like the better-developed fifth metacarpal.

Examination of the skeleton of aurochs in the U.S. national museum shows that the facets for the articulation of the fifth metacarpal are much larger and more sharply defined than are those for the articulation of the second.

Owen notes that the genus Bison has two small metacarpals, and it would seem safe to assume that this is the normal number, the Cambridge skeleton being in this respect abnormal.

The deductions that I would make are these: —

1. Bison bonasus possesses two rudimentary metacarpals, both of which articulate with the common bone by arthrodial facets.

2. Bison americanus possesses two rudimentary metacarpals, but the outer one alone regularly articulates with the cannon bone.

To Dr. Slade, however, belongs the credit of pointing out that in this respect the American and European bison are different, and that the American is just a shade more modified. FREDERIC A. LUCAS.

Washington, D.C., April 29.

### The maxillo-palatines of Tachycineta.

The person who 'found fault' with Dr. Shufeldt's figure of Tachycineta thalassina (see *Science*, ix. No. 221) would like to say a few words by way of explanation. I regret that my remarks should have been construed as mere fault-finding. Nothing was further from my intentions, and I should be extremely sorry to have requited the many courtesies received at the hands of Dr. Shufeldt in any such manner. The shape of the maxillo-palatines of Tachycineta constituted one of the links in the chain of Dr. Shufeldt's argument; and, as my own conclusions in the subject under discussion were quite different from his, it was needful for me to point out any flaws, either of text or figure, which had a bearing on the subject. While, at the time of writing the 'Affinities of Chaetura,' there was no specimen of T. thalassina at my disposal, I did have many specimens representing every other species of North American swallow. All of these agreed with one another in the shape of the maxillo-palatines, and differed *in toto* with those of the skull figured by Dr. Shufeldt. On the strength of these facts, I ventured to state that the figure was imperfect in this particular; and a skull of T. thalassina since procured has the maxillo-palatines like those of its relatives. Of the accompanying figures, fig. 1 is a tracing of Dr. Shufeldt's figure in the Proceedings of the zoölogical society, fig. 2 is the same figure with the maxillo-palatines drawn from a specimen in the national museum, while fig. 3 represents the palate of the purple martin (Progne subis), which shows the characteristic form of the Maxillo-palatines in the swallows. Fig. 2 is not quite so good as I would like, but there is no time to make a better figure. In the examination of scores of crania, representing many species of birds, I have never met with a single case of individual variation of the maxillo-palatine process, to say nothing of so great a departure from the specific type as that indicated in Dr. Shufeldt's figure. In fact, the shape of this process has been found very constant in closely allied species, all the thrushes examined having one pattern, the wrens another, and so on. This being the case, it would

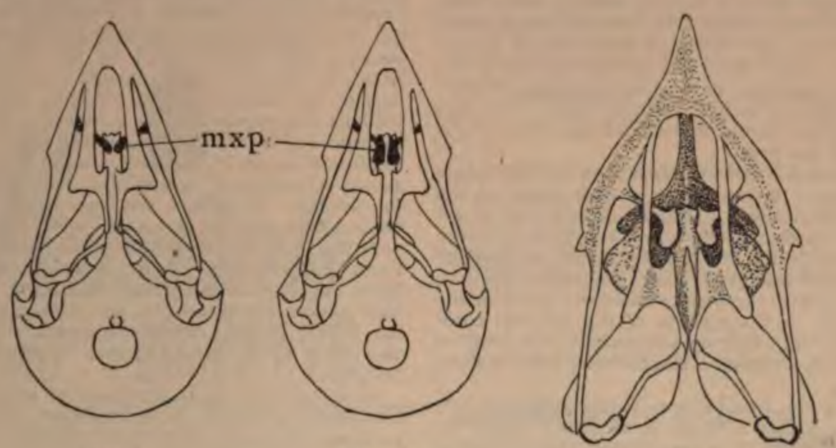


FIG. 1. FIG. 2. FIG. 3.

seem unfortunate that the skull in the Proceedings of the zoölogical society should have been figured as a *typical* cranium, and that no mention should have been made of the fact that it was aberrant in so important a particular. FREDERIC A. LUCAS.

Washington, D.C., May 3.

### Some trees.

In September of 1885, I was present at and assisted in the following measurements of an iron or lever-wood tree (Ostry virginica) on the grounds of Lyman Child, Esq., near Bethel village in Vermont: circumference at ground, 128 inches; one foot above ground, 83 inches; four feet above ground, 69 inches; with corresponding diameters of 3 feet 7 inches, 2 feet 7 inches, and 1 foot 11 inches; height of tree, 38 feet; lateral extent of branches, 47 feet. It stands on a barren, precipitous hillside, and can find nutriment in little else than the disintegrated granite rock. In much travel and a long life in east and west, I have never seen one but this, of even one-half this size.

At Excelsior Springs in Clay county, Mo., some thirty miles from Kansas City, stands a maple (Acer Sach) and white-oak (Quercus alba) joined in one symmetrical body, from the ground up about six feet; thence dividing into two separate trees of some fifteen to eighteen inches diameter each. The line of union of the bodies is only indicated by a slight crowding of the bark.

Near the same Excelsior Springs an oak and maple of some twelve inches diameter each, stand at the ground two feet apart. At about fifteen feet above the ground, in their earlier growth, a limb from the maple was projected horizontally across the body of the oak. Time and growth have embedded the limb from the maple in the body of the oak; and now the appearance is, on the one side of the oak, an anastomosis with the maple by a three-inch arm, and, on the other side, a two-inch maple-limb produced from an oak-tree.

A slippery-elm tree (Ulmus fulva) stands in our yard here in Kansas City, of some thirty inches diameter, at one foot from the ground, and averaging twenty inches for twenty feet upwards, and thence twelve inches for forty feet; entire height, about eighty feet. I find no such Ulmus fulva in Gray; but its sweetish, mucilaginous inner bark pronounces it a real fulva. Its terminal branches, often in whorls of from three to seven, are blunt and club-like, unlike the light pendant terminals of many of the American or white elms. Other specimens of this elm are in the vicinity, but not often so symmetrical in form. A. L. CHILD, M.D.

Kansas City, Mo., May 3.

### The Daniel Scholl observatory.

It occurred to me that it might be of interest to you and your readers to hear that in the old historic town of Lancaster City, Penn., an observatory named the Daniel Scholl observatory has been erected on the grounds of Franklin and Marshall college. The equipments consist of meteorological apparatus, chronometer, Seth Thomas thirty-day regulator, chronograph, transit instrument of three inches aperture, and a Clark-Repsold equatorial telescope of eleven inches aperture. The telescope has a set of negative and positive eye-pieces, with reversion prisms for three of the micrometer eye-pieces, a Mertz solar eye-piece, and a comet eye-piece, together with a micrometer with complete illuminating apparatus for bright and dark field as worked out by the Repsolds. Since this is comparatively new, and, as far as we know, the only micrometer and purely equatorial mounting by Repsold in this country, we thought it might be of some interest to those who have not had the opportunity to see this form of mounting and micrometer.

JEFFERSON E. KERSHNER.

Lancaster City, Penn., May 7.

### Death of Prof. William Ashburner.

William Ashburner, the well-known mining engineer of San Francisco, died in that city, April 20, after a brief illness. The deceased held a high place in his profession, and was greatly esteemed by all who knew him. He was born in Stockbridge, Mass., in 1831. He attended the public schools of his native town. In 1849 he entered the Lawrence scientific school at Cambridge, and after two years went to Paris, where he pursued such studies as are requisite to the profession of mining engineer, at the Ecole des mines. In 1854 he returned to this country, and, accompanied by the late Professor Rivot, he devoted several months to the examination of the mineral region of Lake Superior. In 1859 he was engaged in the exploration of a part of the island of Newfoundland, and in 1860 he went to California as one of the chief assistants in the state geological survey of which Prof. J. D. Whitney was the director. In 1864 he was appointed one of the commissioners of the Yosemite Valley and the Mariposa Big-Tree Grove, a position he held until 1880. From 1862 until 1883 Professor Ashburner was actively engaged in his professional work, and travelled almost incessantly in the mining districts of the United States, British Columbia, and Mexico, also in the more distant regions of South America and Asia.

In 1874 he was made professor of mining in the University of California, and subsequently honorary professor of mining in the same college. In 1880 he was appointed by the governor, regent of said university, and was a member of the board of regents at the time of his death. He was selected by the late James Lick as one of the trustees of the California school of mechanical arts, this latter being one of Mr. Lick's public benefactions, and was also chosen by Mr. Stanford one of the trustees of the Leland Stanford, jun., university. Professor Ashburner was otherwise prominent in various scientific and educational societies, particularly in the California academy of sciences, in which for many years he was one of the trustees. He was also a member of the microscopical, historical, and geographical societies of San Francisco.

In the community in which he lived for so many years, he was universally recognized as a public-spirited and honorable gentleman. His quiet and unostentatious manners, as well as other agreeable personal qualities, endeared him to a large circle of friends.

The enthusiastic and active interest he took in every thing conducive to the growth and intellectual advancement of the Pacific coast made him a valuable citizen, and his death may well be regarded as a public loss. R. E. C. S.

Smithsonian Institution, Washington, May 9.

# SCIENCE.

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SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 13, 1887.

## *THE RESPECTIVE FUNCTIONS IN EDUCATION, OF PRIMARY, SECONDARY, AND UNIVERSITY SCHOOLS.*[1] — *II.*

I. I HAVE said that the chief aim of the primary school is the nutrition of feeling, inner and outer. The child is receptive, and his will is weak. This receptivity is a wise provision of nature for future growth. To all the primary sentiments which distinguish man, the child is more open than the youth. You may play what tune you please on his sensitive chords. Let us take care that it is always a melody, and not a discord of jarring notes. No educational enthusiast has ever yet exaggerated the impressionability of the child, his capacity for the emotions which lie at the basis of all our moral life. Love, tenderness, sympathy, the approbation of others, veneration, nay, even the spirit of sacrifice, and even a certain dim imagination of the harmonious play of all the finer feelings, are all ready, nay, anxious, to be stirred into activity. Response is eager. It even anticipates appeals. What, after all, do our greatest heroes show to the admiring crowd but simply these primary sentiments gathered into a unity of life in them, directed to some great purpose, furnishing the motive forces of their greatest deeds? You have in these primary feelings the well-spring of all life. Do not distrust them. Believe in them. The child before you is not an incarnation of depravity. That is an old-world fable. He is nearer God than you are. Heaven lies about him. Christ did not say 'Of such is the kingdom of heaven' to furnish a text for the glosses and distortions of theologians in their bilious moments. Depend upon it, he meant it. It is by the watchful guidance and gentle admonition of the child that you lead him to the right and good. You do not *supply* motives for his daily acts, you evoke them out of himself. They are there waiting to be turned to use. It is your privilege to touch him to fine issues. Your business is to be watchful, but not suspicious. The loving hand pointing the right way, the warning finger (with perchance a smile behind it) blocking the wrong path, the supporting of the weak will with your strength, — these are your methods. To preach is futile. Food so offered will be rejected. It is by the presentation to the open mind of individual instances, the direction and encouragement of individual acts, that you give the sustenance the child needs; above all, by making *yourself* a particular instance, always present to him, of kindliness, of justice, of mercy, though not without the occasional anger that 'sins not.' In such teaching, severity and harshness are surely out of place. I often smile in schools at the solemn exaggeration of children's offences when I compare their young untried souls with the tarnished conscience of their teacher, the aggregation of iniquities which are incarnated in the dominating and indignant master. He, forsooth, is virtue: the child is vice. Look on this picture and on that! Does it not ever occur to him how gladly even he — magister, dominus, scholasticus — would change places with those young souls?

> "Not poppy, nor mandragora,
> Nor all the drowsy sirups of the world,
> Shall ever medicine *us* to that sweet sleep
> Which we owed yesterday."

But enough of this: the aim of the primary school, I repeat, is nutrition of inner feeling, of the emotions and sentiments through particular instances. The soil is thereby enriched and prepared for the harvest virtue.

But nutrition of inner feeling is not all: there must be nutrition of outer feeling. The real of nature, as well as the real of emotion, is the material of primary education. It is life that educates. Outside the school-room the child lives in an ever-changing atmosphere of emotion chaotic and perplexing: inside the school-room the same life is to be found, but regulated, controlled, explained, enriched, by the teacher. So with the real of outer sense. Outside the school-room the child lives his life under sense conditions. He is feeling his way to the understanding of the objects around him. Nature, and the products of the hand of man working on the crude stuff of nature, press on him. He has to establish relations with all these, that he may use them for life and work and enjoyment. They are, in truth, the raw material which he has to shape to moral and spiritual ends. This outside life is also to be the inside life of the school. The teacher has to help the child to see, and understand, and to organize his impressions. Thus, when he goes out of the school, he goes out, not to a novel world, but to a world already experienced and now par-

[1] Paper read at the Educational congress, Edinburgh, Dec. 31, 1886.

tially explained by the teacher's better knowledge, and with an increase of the power of seeing and knowing and correlating.

Such, I think, is the function of the primary school as the nurse of feeling and the home of training, but not, as I have said, wholly without discipline. The voice of authority must always be heard. The child must learn that he lives and must live under law. The merely intellectual discipline is sufficiently insured by the acquisition of the subsidiary attainments of reading, writing, drawing, arithmetic, etc.

II. At the age of approaching puberty (about fourteen) we pass into a new sphere. At this age the boy tends to become boisterous, and the girl skittish. Our work now is mainly governed by the purpose of discipline. Law now meets and controls the turbulence of the phase through which the human spirit is passing. Nutrition, it is true, is never to be absent — nutrition which is possible alone through the real of inner feeling, and the real of outer nature; but if the foundations of the real have not been laid in the primary period, I doubt our success now. Opportunity is offered once to all. It may never be offered a second time. The teacher, at least, must assume this. The nutrition to be given now is the nutrition of law and duty.

Nature seems now to yearn for activity. The boy is no longer so ready to receive impressions as to make them. His will, or what he mistakes for his will, comes to the front, and in bodily and mental matters alike he loves to *do*. He cannot bear being talked *to* or talked *at*. He has opinions now. He judges with imbecile self-complacency things and men. He wants to show what *he* is, and what he can *do*. How are we to meet this? Really a difficult question. For we have, above all things, to let him grow, and growth is not possible with suppression: nay, suppression at this stage enslaves and converts the less bold into skulks and sneaks, and the more bold into evasive dodgers paltering with the truth, and both into contemners of the pure and good. Here the boy himself points the way to the teacher. Work is what he needs, and wants. Let him have it. Let him be brought to face difficulties in learning, and, though some of the subjects want the attraction of the real, let him learn to master them by sheer force. Formal studies, — languages and mathematics, — with the rudiments of which he has been conversant in the latter portion of his primary stage, must now occupy more than one-half of his time. His specific moral life, again, can now no longer be stimulated or fostered by sentiment, as when he was a child, but only indirectly, and that by intercourse with moral ideals in conduct. This is the age which can appreciate heroism, and understand the sterner and heroic virtues. So with ideals in the things of intellect and literary imagination. Art in literature will unconsciously impress him and mould him. We must not always improve upon the lessons: we must let him draw his own inferences. I believe much in literature at this stage as the chief real or nutritive element, in its silent influence on character, much more than I believe in the real of nature as presented in elementary science, because the concrete idea is not in it. This last too, however, must have its due and daily place. The order observable in the external world may possibly help to bring order into the internal chaos, which at present constitutes the boy, spite of all his pretentiousness and conceit.

But not only is his rampant will to be brought in contact with the hardships of intellectual work that it may face and overpower; his body also must be allowed its full activity. In gymnastic, and, above all, in organized games, he should find an outlet, and also a discipline, — the discipline of difficulties overcome and of law obeyed.

Thus between fourteen and eighteen we gradually subject the boy to law, and give him the priceless possession of concrete ideals in conduct — great personalities — and of art in literature. He is thus tamed, if not subjugated; and, when he approaches the gates of the university, his brave show of self-importance, were he dissected thoroughly, would be found to be hollow at the heart, and to mean little more than the walking-canes, neckties, and general masherdom by means of which he harmlessly works it off to the admiration of that other half of humanity, whom, formerly despised with all a boy's contempt, he now desires above all to attract. Desires to attract, I say; for it is not the fairer half of creation he is yet thinking of, but of himself alone as an irresistible object of admiration to that fairer half, — an excellent arrangement of nature, for thereby he forms an ideal of what he ought to be by seeing himself through the rapt eyes of imaginary admirers.

III. He is within the academic gates, and we have now to ask what is the function of the university in regard of him. I may be heretical, but I do not believe the university forms character. Character, in all its essential features, is already formed in the young matriculant. The home and the school have done this. The university may supplement their work: it cannot do it.

The function of the university has more close relation to that of the primary school than to that of the secondary school. Its aim is like that of the primary school, chiefly *nutrition*, but no

longer of feeling as in the primary, or of moral ideals and of law as in the secondary, but of ideas. Training and discipline are, it is true, involved in the true grasp of ideas, but they are not the university aim. The nutrition of ideas, — this is the great academic function, as I think. Nor are discipline and training to be given *by* the university, but by the student to himself. The youth has now escaped from the bondage of law. The university does its work when it unfolds the domain of knowledge to the opening adolescent mind, and invites it to enter in and take possession, and when it provides the material apparatus of self-instruction. The professor is only a guide and an example. The essence of university life is freedom for the student, and freedom for the professor. It is simply because the university has become a certifying and graduating body that even the calling of class-rolls is justifiable. Even as a graduating body, I doubt, after all, if it is justified in calling them. The professor offers to show the student the way to knowledge, and to teach him how to use the instruments of knowledge, whether they be books or microscopes; and there his function ends. If any parent is unwilling to send his son to the free life of a university, let him keep him at home and call in a trained nurse or a paternal tutor.

*Self*-discipline, *self*-training, through the pursuit of ideas which attract by their eternal and inherent charm all ingenuous spirits, — this is the purpose of a university. There can be no self-discipline without freedom. This is of the essence of mind: God has ordered it so. True, freedom may end in tasting of the tree that is forbidden, and in expulsion from Paradise. Be it so. Such is the universal condition of adolescent and adult life. By bringing to bear the schoolmaster — the law — on the student, we make the unworthy less worthy, and the worthy we irritate and repress in their upward and onward striving.

What follows from this general view? Certain very practical results. Boys in years and boys in mind, though they be physically grown up, have no business within academic walls. Their place is the secondary school, where they may receive the intellectual and moral discipline which fits them to breathe the pure air of freedom and the rare ether of ideas. Freedom of study also, not compulsory curricula, is alone in place now.

And what are ideas? Shall I venture on a definition where Plato failed and Aristotle stumbled? I would rather not. And yet I know what I mean. For is not 'the true' an idea? And is not the pursuit of science and philosophy the pursuit of the true? At these academic gates the student is to cast aside the idols of the den and of the market-place, and, unencumbered, to question and to investigate in loyal obedience to the divine summons to *know*. In philology, in philosophy, in the study of nature in its many forms, in art, he is called upon to look face to face with the true, the good, and the beautiful. Even when the student himself is all unconscious of the divine presence in his ardent pursuit of material science, it is yet there, for his aim is the true. Step by step he is putting himself in harmony with the scheme of the universe, and preparing for the final illumining. The truth of this and of that he seeks for; but these separate truths are but the fragments of the whole, and lead him to the whole. He is always on his way upward. The conception of the unity of the whole, as seen in the wisdom and working of the eternal Reason, teaching him by the things which He has made, awaits him. The student-spirit is thus brought into relation with the universal Spirit, which effects in him the fruits of the spirit; above all, harmony of soul and all the virtues.

It is philosophy, and history treated in a philosophical sense, that hold the key of the temple. And if philosophy should fail him, literature will be found to be a universal solvent; for in itself it is the creative thought of man on man cast in beautiful forms. It is a striving after the truest truth and a direct and informal penetration into the heart of things; it lives *in* the idea and *by* the ideal. Harmony of thought and life — a tie between all special knowledges — may be found here.

It is scarcely necessary to say, that, when I speak of science and philosophy, I speak of arts in the mediaeval sense, — the whole circle of rationalized knowledge. The merely professional studies which fit to be physician, theologian, lawyer, teacher, are mere dependences on the university properly conceived, mere accidents of the substance. The university itself was founded in arts, and still truly lives only by arts. An aggregate of professional colleges can never constitute a university. The idea is not there: it cannot live with the purely technical. Even in technical schools, at least if they are part of a university organization, no man is a fit professor who is not alive to the university idea in what he teaches, makes his students feel the intimate relations of all knowledge, the philosophy which permeates and gives significance to every subject. If the student does not attain to this, he has fallen short of the academic aim.

But how can the student breathe the purely scientific atmosphere if he does not come prepared? If he spends the years of his arts life in acquiring the mere instruments, linguistic and

mathematical, he can never enter the temple of science at all. At best he can take but a cursory peep. I am well aware that the world gets along by compromise, and I have no objection to a year or so being devoted to the mere instruments within the walls of a university; but let it be understood, that, even when we accept this, we must yet demand a much higher qualification in the matriculant than we do now. After a year spent among the instruments, the student, at the age of about nineteen, should be in a position to throw himself into real studies, — philology, philosophy, history, literature, art, physical science. To take the encyclopedic round would be impossible nowadays; but by the thorough investigation of a department he gains admission to the idea, and becomes a scientific thinker. Discipline in one department, properly understood and properly pursued, is discipline in all. He thereby attains to that reverence for all knowledge, and that large philosophical comprehension, which is the consummation of all true self-discipline. Thus it is that the mere intellect becomes permeated by the emotions which lie at the heart of all ideals, and becomes itself ideal and universal in its *personal* aims. This is what culture truly means.

Too briefly for the great subject, but not too briefly, I trust, for understanding, I have indicated the function of the university in education. Out of it the equipped man issues to encounter the buffets of life, and do the work which his hand findeth to do; but he can never forget that he has enrolled himself a citizen of the city of reason, and that he is a freeman of it by divine right.

All stages of educational progress you will, I trust, see gain their true significance, from their genuine ethical outcome, — their contribution to harmonious inner life, and harmonious outer living.

S. S. LAURIE.

## *COMPETITIVE EXAMINATIONS.*[1]

THE subject which I have chosen for this evening's discussion you will probably regard as a well-worn one. But the working of examinations has now undergone the test of a lengthened trial; and much of the controversy respecting their educational value, which raged some ten years ago, has in a great measure subsided.

It therefore occurred to me that a retrospective view of what has been said or written by advocates on both sides of the question might be useful, if taken in the light of our accumulated experience.

It will be in the memory of most of us, that, between the years 1870 and 1880, our magazines teemed with articles on the subject; and there is so much that is suggestive and worth recording, that I must crave your indulgence for making frequent extracts from different papers. According as writers were interested in maintaining the old public-school system of education, or the system supported by the modern examination coach and so-called 'crammer,' they ranged themselves against or in favor of competitive examinations.

Some of the arguments hurled at the concoctors and upholders of the examination system were the following: —

Examinations led to cramming on the part of the candidates; i.e., preparation by pure memory-work, leading to a parrot-like acquaintance with facts and phrases, and even this knowledge quite transitory, learned for the purpose of the examination, and forgotten as soon as it was over.

The reasoning-powers were said to be stultified by disuse.

Imagination and originality were crushed.

The strain of competition would undermine the health of the young.

The artificial stimulus of competition would take the place of a healthy love of study for its own sake, and, when withdrawn, the genuine interest in work would never return.

In the Indian civil service the result would be that the worst candidates would be selected, and the best rejected.

On the other hand, the advocates of examinations contested these points one by one, and maintained the opposite conclusions. They affirmed that the competition and rivalry excited was a positive good in the training of the young; that, to make a great struggle for a place in an examination, even but once in a lifetime, was itself an education to a naturally indolent mind; that the system afforded the only method, free from chance or favoritism, of selecting candidates for innumerable appointments in life. They also maintained (and not without reason) that prizes for learning, and orders of merit, advanced the character of the teaching given to the whole of a school.

Amongst the opponents of the system, we find Dr. Birdwood, in an address before the Society of arts about the year 1873, — an address indorsed and eulogized by the *Standard* in a leading article at that time, — denounced the army and civil service tutors as "a gang of examiners, and the directors of the new East India competitive examination Dodge company." But in this anathema it is clear that he ought to have included the civil-service commissioners, who are the real directors of those examinations.

[1] From the *Educational times*, April 1. A paper read before the College of preceptors.

The *Fortnightly* for June, 1875, contains a long article by Professor Sayce, which, from beginning to end, is a tirade against the whole system.

From much that has been written tending in the same direction, it will suffice to make an extract from a very able article by Mark Pattison, in No. 1 of *Mind*, 1873, bearing the title 'Philosophy at Oxford:' —

"The whole of the literary and philosophical teaching in Oxford is in the hands of young men, — the tutors of the colleges. As a class, these men abound, when they begin life, in energy and ability. They overflow with zeal, and the desire to act upon their pupils. But the zeal is not the zeal of the enthusiastic votary of science, who sees a vista of infinite progress opening before him, and desires to associate younger minds in following up the track. The young teacher, as turned out by us, has never been on any such track. He is an honor-man and a prizeman; *voilà tout!* and he knows the sure road to make others win honors and prizes, the road by which he himself won them. He is embarked on the career of teaching at twenty-five, say, and he finds himself at once the slave of a great teaching-engine, which drives him day by day in a round of mechanical work."

On the mode of preparation for examinations in philosophy, he goes on to say, —

"For two years the pupil is forced along a false road of study, in which neither science nor philosophy encounters him. Memory is really almost the only faculty called into play. Were they facts with which the memory is thus charged, the inadequacy of the system would be apparent at once. But in the preparation for this examination, instead of facts, the memory is charged with generalized formulas, with expressions and solutions, which are derived ready-made from the tutor. The first principle of philosophical, nay, of intellectual training, viz., that all should be educed from the pupil's own mind, is here inverted: all is poured into him by his teacher. The teacher does as much, and the pupil as little, as possible. The utmost that the student can acquire from the system is, that he has learned to write in the newest style of thought, and to manipulate the phrases of the last popular treatise."

Later on, however, we find more moderate views prevailing. In the *Nineteenth century* for April, 1878, Canon Barry of King's college, London, writing on 'The good and evil of examinations,' says, —

"We can now afford to take the wise advice of Carlyle, 'to stop shrieking, and inquire.' There seems to be no inconsiderable danger that to an exaggerated trust in examinations there may succeed an excessive and indiscriminate condemnation of them. Whenever one party vaunts a medicine as a panacea, their opponents are seldom content without denouncing it as a mere sham, or perhaps a deadly poison. . . . I hold it possible, by an examination, deliberately and carefully conducted, to test and to estimate, in those who are submitted to it, not only formed knowledge on this or that subject, but intelligence, thoughtfulness, and promise of future growth."

The whole subject will be found exhaustively treated in Todhunter's 'Conflict of studies,' 1873, and, four years later, in Latham's 'Action of examinations.'

First and foremost amongst the evil things which have been charged to the account of examinations is *cramming*.

Now, if the nature of competitive examinations is such as to involve, as the necessary and sufficient preparation for passing, the storing the memory with a mass of unclassified facts, and the accumulation of a huge heap of undigested knowledge, then the ultimate benefit accruing to the candidate is easy to foresee: it will be of the smallest possible amount, or the result may be even positively injurious to him. An examination which necessitated a mental process of this kind would be framed in the worst possible way, yet I find that it is such a process as this which is popularly denoted by 'cramming.' The term must therefore be equivalent to 'preparation for a bad examination.' But are all or any of the existing public examinations of this description?

That many candidates attempt to pass these by acquiring a mere mnemonic acquaintance with the several subjects, and that a very few succeed in the attempt, is the probable truth; but to infer that most of the candidates do so, is an *ex pede Herculem* mode of reasoning, the fallaciousness of which appears at once. For, let any one carefully inspect the papers set in the university, the Indian civil service, and the Woolwich examinations, and then ask himself if it be possible for a successful preparation for any one of these to be accomplished by the process of unintelligent 'cramming' just described. The answer ought to be an unqualified negative, and must be so if the examiners do their duty. In fact, much of the charge of inefficiency brought against these examinations must be borne by those who originate and conduct them. On this point, Canon Barry holds similar views, and says, —

"I maintain that an examination ought always to be able to defeat those crammers, who are properly so called. If it does not, the fault is to be traced to the imperfect discharge of duty by examiners. Those who carelessly set stock questions, and questions which can be answered by

memory without thought, or make their papers a field for the exhibition of their own cleverness and their own peculiar theories (without considering what may rightly be expected from the young men or boys examined, and what is therefore likely really to test their knowledge and capacity), simply court failure. There seems to be too little appreciation of the exceeding difficulty of the task of thorough examination. Examiners are burdened with a mass of work which they cannot get through except in a perfunctory manner, and which even then so utterly wearies them out, that this faculty of judgment and comparison is lost. They themselves sometimes seem to act as if any thing would do for an examination paper, and, unless they are strangely belied, are far from preserving a uniform standard in their arbitrary and irrevocable decisions. But the fault lies, not in the principle, but in the administration. It is remedied, not by giving up examinations, but by examining better."

In the address before referred to, Dr. Birdwood expressed the views held, then and now, by a considerable class, when, after drawing an ideal picture of the lamentable effects of this so-called system of cramming upon the Indian civil service, he boldly proposes, as a remedy, to hand over all the appointments to the universities and the public schools. This advice is doubtless consistent. If the knowledge which it is at present necessary for candidates to acquire, over and above that which they can obtain at the public schools, is only so much useless rubbish, unfitting instead of fitting them for the sphere in which they have to act, then the sooner it is dispensed with, the better. But it is difficult to discover where the *gravamen* of the accusation lies. The fact that a special education of a higher order than that which the public schools will give is required by the civil-service commissioners is obvious enough; but it is not easy to see how a better education can make a man worse: it certainly cannot be proved to do so by giving it an uncouth name. The rapid strides of science, and its intimate relation to all civilization and progress at the present day, led the commissioners to recognize the truth that a wider foundation than heretofore had to be laid for the education of those who are destined to take active service in the field. For the mere onlookers, a liberal education, according to the ideas of the old *régime*, may suffice. The public schools may remain faithful to the traditions of the past, and continue to insist that two dead languages constitute for all time the one necessary and sufficient basis for the complete education of the Anglo-Saxon. But the world will not stand still forever to worship this ancient 'idol of the den.' The movement which has resulted in draining, year after year, some of the best blood from our public schools, is but the beginning of a process which will ere long leave them dry and lifeless, if they persist in disregarding the signs of the times. It would be as useful to make technical botany, geology, or chemistry the universal substratum of school-education, as the Latin and Greek tongues; for the average school-boy never gets beyond the dead symbol of the language, which bears no fruit for him. The philosophy of history, the poetry, wisdom, and learning of the ancients, all that constitutes the hidden life of such studies, is lost to him through the obscurity of the medium. Neither can he arrive at this knowledge in such a way, any more than the ear can arrive at sweet sounds by learning the rules of harmony and thorough bass. And just at the time when those studies might begin to educate, in the true sense of the word, they are laid aside forever.

The charge of specialty and inutility which has been brought against the civil-service examinations is singularly inappropriate. We find the following astounding statement: "The training required (that is, for the civil-service examinations) was absolutely injurious, and was good only for the competitive examination itself, and worthless for all else beyond as well as below it. To fail in the examination was bankruptcy in purse, in mind, and in soul." Now, since the subjects in which the specialty consists are almost wholly comprised under the heads of modern languages, literature, and some of the chief branches of physical science, — subjects the knowledge of which forms the very life-blood of our social and commercial systems, — it is impossible to conceive that the circumstance of having paid more than ordinary attention to such branches of study could unfit a young man for making his own unaided way in the world, after having failed to secure a civil-service appointment. In fact, the argument, such as it is, recoils with tenfold force upon the public schools with which the comparison is instituted. It is there that the course of education pursued is special, and the results comparatively worthless. It is there that subjects which are of use only to the man of letters, or the professional linguist, are dragged into undue prominence, and made to form the staple of the instruction offered, without discrimination, to all. If the hypothetical youth who has been early stranded in life had just left a public school, he would perhaps have acquired a facility in writing execrable Latin hexameters, or in making equally bad translations of Euripides; but in the elementary knowledge useful in a score of professions he would be utterly and hopelessly

ignorant. In truth, if the heroes of Greek and Roman mythology had been indeed divine, we could hardly have expressed our belief and devotion more practically than by adopting the grammar of their language as the common basis of education in the nineteenth century. Perhaps the afflatus still clings to the disused words, and man's progressive improvement may somehow be indissolubly connected with the repeated incantation.

We are told that the public schools produce 'formed men,' and the competitive examinations 'crammed men;' but the antithesis is not clear, and definitions of the terms employed would have been acceptable. It is doubtless true that independence of spirit and self-reliance are created at the public schools, and the result, as far as it goes, may be very valuable; but intellectual training is at least of equal importance with social in formation of character, and it is the former that we assert to be inefficient. The term 'cramming' is either a perfect myth, as Mr. Todhunter has affirmed it to be, so far as it has reference to the examinations in the University of Cambridge; or, if its present application be a legitimate one, it means, in the pupil, more than usually hard and intelligent study, and, in the tutor, thorough and painstaking teaching. The boy who is taken from the public schools to be 'crammed' for the competitive examination, is brought into incessant contact with his tutors, is individually assisted in his studies, his difficulties are explained, and, if idle, he is perpetually encouraged to work. The specialty of the method consists in giving individual attention to each pupil, and so, by obviating waste of time and waste of effort, enabling each to take the shortest road to the end desired. It is obvious that such a method involves more actual teaching; yet with reference to the expense attending this tuition, and which has been represented as enormous, I am confident that a fair average would show that it does not surpass, even if it equals, the cost of education at the public schools. It is impossible to resist suggesting an amendment to Dr. Birdwood's proposal. Let the public schools alter their curriculum to suit the requirements of the competitive examinations, and treble their staff of masters, and let them do this without raising the school fees, and they will at once become formidable rivals of the so-called crammers.

Granted, however, that the evils complained of, and so much exaggerated, exist in any degree whatever, the subject is one which demands immediate and serious attention. The whole tone of education in this country is being influenced, and in some directions entirely determined, by the character of competitive examinations. And it is therefore hardly possible to overrate the importance which attaches to these examinations, and to the question 'How can they be made most serviceable?' In the last edition of the 'Encyclopaedia Britannica' there are some pertinent remarks on this head. The writer says, —

"It is found that some branches of study are better suited for examination than others. Certain studies endow the pupil with the faculty of *doing* something he could not do before, such as translating foreign languages, or solving mathematical problems; and there are others, like history, which, though they may add greatly to the wealth of the man's mind, yield no such definite faculty or technical dexterity. We can test the possession of the first sort of acquirement directly, by calling on the student to put in practice the powers he is expected to have acquired; but, with respect to the latter, we can only ascertain that he recollects some portion of what he has prepared. By choosing these portions judiciously, we can tell whether the student has carefully studied the subject and linked the various parts of it together, but we cannot make sure of the permanency of this knowledge. Young men used to examinations will pick up just the information suited in a very short time, from an analysis or a tutor's note-book, and forget much in a few days. This power of 'getting up' and carrying is not without practical value. It is the power which enables a lawyer to master a mass of details, and we may allow credit for this, for it shows a good analytical memory; but it must be observed that what is thus rewarded is not so much a knowledge of the special branch of study, as a *power of acquiring*, which, very probably, might be applied to one subject as well as another. It requires great experience and judgment in an examiner to deal with subjects like history and literature. He must have an eye for the cardinal points, and must know how a student ought to hold things together in his mind. If he yield to the temptation which seems to beset examiners, of picking out 'things not generally known,' and minute details which a wise man is content to leave to be looked up when he wants them, then a kind of artificial knowledge, solely for use in examinations, will be engendered."

The opinion that there is something in the nature of examinations which renders them, of necessity, not only inefficient as a test of mental culture, but absolutely prejudicial to the interests of education in general, is, I am convinced, erroneous. I believe that the capabilities of the competitive examination, regarded as an instrument for directing education and for proving its results, have never yet been fully recognized. I do not think that attention has been concentrated upon

the subject which its importance demands; and the reason for this may be, that the real magnitude of the effect producible through the agency of these examinations is overlooked; and this is partly through the simplicity of the agent itself, and partly on account of the difficulty of observing the subsequent effects upon individuals. It is curious to compare the seeming inadequacy of the means employed with the actual vastness of the result. Some dozen or twenty questions are set in each of a few papers once or twice a year, and the whole machinery of education in innumerable schools and colleges is guided at the will and pleasure of the examiner. The instrument placed in his hands is the examination paper, and he can fashion it as he pleases. Any branch of study may be admitted or excluded, and I maintain that it is in the power of the examiner, not only by the selection of questions to give prominence to any particular department of the subject of a paper, but also by judicious apportionment of marks to give weight to certain mental excellences of the candidate over and above the mere exercise of memory and rule of thumb. No doubt a discrimination of this kind is already exercised in some degree: but, in order that such a method of awarding marks should become practically effective, it would be necessary that a complete understanding should exist between the examiner on the one hand, and the pupil on the other; for, since all efforts of the candidate, both before and during examination, are certain to be regulated by his idea of what will be likely to pay, it is evident, that, if his notions on this point differ widely from those of the examiner, the best intentions of the latter may be frustrated. As examinations are at present conducted, very little or no information is given about the method of marking adopted. The one fact ever present to the mind of the candidate is that he has to answer correctly the largest number of questions he can within the allotted time.

For the sake of illustrating what is, perhaps, the most serious defect in this system of examination against time, let us suppose the case of two students in mathematics, A and B. A is brilliant, but not profound. B is profound, but slow. Six questions being proposed to them on paper, A answers them all in one hour, while B only answers four out of the six in the same time. Again, six more advanced questions being set, requiring more original thought, A is unable to answer any one of these, but B answers them all in five hours.

Now, suppose A and B to compete for mathematical honors at Cambridge, in the old tripos examination. A number of questions of the first sort, all within the scope of A's ability, are answered by him in the allotted time; B answers two-thirds of that number, and is accordingly beaten by A. The paper probably contains no questions of the second sort, and, even if it did, B would not venture to grapple with them, being deterred by the fear of losing marks, since in the time which the solution of one of these questions would take he would be able to deal with three or four of the easier ones. That such a result would be mischievous, will probably be admitted. In the ordinary affairs of life it is rarely of any consequence, when a matter is submitted to the judgment for decision, whether five or ten or fifteen minutes be occupied in coming to a conclusion. In the higher walks of science it is positively of no consequence whatever, the importance of arriving at a truth at all outweighing all consideration of the time occupied in the process. As an original investigator, A would be altogether surpassed by B. Why, then, should a premium be offered to mere rapidity of thought, in preference to any other excellences which might be displayed, in an examination the avowed object of which is to gauge the mathematical abilities of the competitors? If such ability as that of A's were usually allied with power, the objection would lose its weight, but the rule is probably the reverse of this: slowness is found allied with profundity and strength, quickness of conception with lack of great mental power.

Often the real difficulty of a question does not appear on the surface, and much time is frequently wasted in exploring the paper, and in attacking questions which have to be relinquished when their real difficulty is perceived; and in this way chance has much to do with the results, for nothing short of a deliberate analysis of the contents of the paper (for which there is not time) would enable the candidate to do himself justice by attacking those questions which alone he would be able to answer in the time allowed. It would also tend to definiteness of aim in preparing for any examination, if it were clearly stated by the examiners that marks would be accorded for certain excellences in the style of answering questions, and marks deducted for certain blemishes; and the more minutely all this could be specified, the less random would the results become, also the more would the character of that course of education, which it ought to be the sole object of the examinations to render perfect, be brought under the influence and direction of the examiners.

What I wish to insist upon is, that the evils which have been complained of as belonging to the system are not evils inherent in competitive examinations as such, but that they are due, wherever they exist, to accidental imperfections

in the mode of carrying out such examinations. It is obvious that any elaboration of the scheme of examinations, of the kind which I have very imperfectly suggested, would increase the labor and cost of conducting them. To insure satisfactory results, it might prove needful to engage a whole committee of examiners where but one is at present employed. Still, in view of the overwhelming importance of the effects of these examinations upon the education of the youth of this country, any objections to change founded upon considerations of economy must be regarded as trivial.

In conclusion, I may say that there appears to be a consensus of opinion in favor of the pass examination, with the subsequent arrangement of candidates alphabetically in one, two, or three divisions, thus reducing competition to a minimum. The College of preceptors has, I believe, never swerved from this principle, and a justification of it is surely afforded by the very marked success which has attended their examinations for a long period of years. The dangers, such as they are, cluster round the competitive examination, with its order of merit attached; and it is pretty generally agreed that young people should not very frequently be called to engage in these contests.

G. S. CARR.

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## THE LONDON COLLEGE OF PRECEPTORS.

THE erection and dedication of a handsome new building for the use of the London College of preceptors has called renewed attention to a most serviceable institution, and one which American educators should know something about. A writer in the *Athenaeum* gives a summary of its history. It is this college, far more than the ancient universities, that regulates and directs the education of the English middle classes.

The College of preceptors had a humble beginning. In 1846 some private school-masters, impressed with the ignorance and incompetence of numbers who called themselves teachers, met together, and ultimately resolved to form themselves into a society with the object of affording to the public a test of the qualification of teachers, and of thus, in course of time, excluding from the ranks of the profession all charlatans and impostors. The college increased rapidly in numbers, and secured the interest of distinguished patrons, among them the late Marquis of Northampton and Sir John Lubbock, by whose aid it succeeded in obtaining the royal charter by which it was incorporated in 1849. The preamble of this charter embodies very clearly the views of the original founders. The college is incorporated "for the purpose of promoting sound learning, and of advancing the interests of education, especially among the middle classes, by affording facilities to the teacher for acquiring a knowledge of his profession, and by providing for the periodical session of a competent board of examiners, to ascertain and give certificates of the acquirements and fitness for their office of persons engaged, or desiring to be engaged, in the education of youth." These primary objects of the college, it may at once be said, have hitherto been carried out but to a limited extent and with small success. At first, by a strange irony of fate, the result of its operations was to aggravate the evil it sought to cure. In the report of the schools inquiry commission, Mr. Fitch stated that in his district the objects of the college had not been fulfilled to any appreciable extent, and that several school-masters of good standing who had once supported it "had withdrawn themselves in disgust at the shameless use which was made in advertisements of the letters M.R.C.P. by men who were wholly unqualified;" and as late as 1868 Mr. Joseph Payne, in a paper read at a meeting of the college, put the plain spoken question, "Can any one wonder that school-masters by hundreds, finding that high rank in a learned corporation was to be obtained at the rate of seven shillings a letter, should have availed themselves of the golden opportunity?" The council have ever since steadily discountenanced the use or abuse of these mystic letters. The only grades the college recognizes for which diplomas are granted are associate, licentiate, and fellow. These grades are conferred after examination, partly in general knowledge, and partly in the theory and practice of education. The qualifications for the lowest grade are about on a par with those of a first-class certificated teacher, the licentiateship corresponds to an ordinary degree, and the fellowship may fairly rank with an honor degree at the universities. The College of preceptors deserves full credit for having first recognized the necessity of a professional examination, and for setting an example which the older universities are slowly following. So far, it has succeeded in attracting few teachers, and those mostly of an inferior class; but the failure is due, not so much to any defects in the scheme, as to the general indifference of the public.

By far the most important event in the history of the college was the establishment of the examination of pupils. This was begun in 1850, and was in full operation in 1854; that is, four years before the university local examinations, and two years before those of the Society of arts. In spite of the competition from these and other examining boards, the college examinations have steadily

grown, till in the last year the numbers who presented themselves for the college certificates amounted to more than fifteen thousand, representing over four thousand schools. This number considerably exceeds the sum of the Oxford and Cambridge local candidates for 1886. Not only was the college first in the field of examinations, but it also took the lead in admitting girls to equal privileges with boys. Nor, as far as we can judge, is there any ground for the prevailing belief that the standard of the college is lower than that of the universities. Certainly this is not the opinion of the best judges, masters who prepare pupils for both examinations; and there can be no doubt that the examination syllabus of the college is more scientifically constructed, and insures a better curriculum for students, than that of either university. The explanation is obvious: it was originally drawn up, and has since been modified, not by university dons, but by practical school-masters.

A few words may be added as to the future of the college. In the past the main energies of the college have been expended on the examination of pupils; and probably few of its members are aware that there is not one word in their charter referring to such examinations, and that it is only by implication that they are authorized in conducting them and granting certificates. Now that the preceptors have built themselves a house, it is hoped that they will set to work in earnest to carry out the main intention of their founders. To offer examinations in the art of teaching is something; to provide lectures for teachers by such competent professors as Mr. James Sully, Canon Daniel, and Mr. Fitch, is more: but both these provisions combined fall far short of the training of teachers. This hope, we are glad to say, is likely to be fulfilled. At the last general meeting of the college, two resolutions were carried unanimously, — "that for the next three years a sum not exceeding three hundred pounds a year be devoted to scholarships for intending teachers, male and female;" and "that part of the surplus funds be allowed to accumulate for the purpose of establishing a training-college, or for promoting some other scheme for the training of teachers." These proposals appear to us most reasonable and prudent. The experiment of the Finsbury training-college proves that a superior normal school for men must for the present depend mainly on external support, and to launch out on such an undertaking without sufficient funds would be again to invite failure.

There are various other objects included in the charter of the college, to which it will doubtless hereafter apply itself. Such are a benevolent fund for teachers, a pedagogic library, a bill for the registration of teachers; but, useful as all these objects are, they are subordinate to the primary aim of the college, the promotion of the training of teachers.

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## *INFANT-SCHOOLS AND THE KINDERGARTEN.*[1]

Now that the universal necessity of education is recognized throughout the civilized world, the contest that remains is that concerning methods; and of this, the most important branch is that which relates to the very earliest period of education, namely, to the choice between the old system of the nursery or the infant schools, and that of Froebel, known as the kindergarten.

It would be obviously impossible to attempt here to give any thing like an exposition of this method, which was elaborated by its author as simply the first step and foundation of a systematically progressive education, extending from the earliest dawn to the ripening of the human faculties. The utmost that can be hoped for, in these brief remarks, is to bring into clear relief some of the most salient points of difference between the old and the new methods of infant-training.

First, then, apart from the inevitable effect of any school discipline upon the habits and conduct of children, the former aims mainly at instruction; the kindergarten, at harmonious development of the child's whole nature, instruction being a portion only of the training required for that purpose.

Next, as to the nature of the instruction given. The infant-school, which is bound to produce at a given time a certain proficiency in reading and writing, laboriously teaches the child to recognize and reproduce certain symbols, the real importance of which he naturally cannot realize. The kindergarten trains the child first to observe form, dimension, and number, in a great variety of amusing ways, with the help of color and of objects he can handle and examine. It teaches him to reproduce the forms observed, whether of natural objects or geometrical figures; to copy or combine out of his own fancy a variety of symmetrical designs, thereby giving a facility of apprehension and execution which makes the subsequent effort to recognize and trace letters and words comparatively easy. Thus the kindergarten system enables the children to attain the same proficiency in reading and writing, while much else has been learned on the way, and while the foundation has been laid for that accuracy and

[1] From the London *Journal of education.*

delicacy of sight and touch which will be of equal importance to the future mechanic, to the artist, or the man of science.

Again, the songs and movements of the infant-school afford a pleasant break in the graver work; but the songs and games of the kindergarten are themselves an integral portion of the instruction. Through them the ear, the memory, and the intelligence are systematically exercised, while the children feel the charm of rhythmical expression and movement.

Once more. While, in any well-managed school, the children are fairly contented, in the kindergarten they are genuinely happy. Parents of all classes bear witness to this important fact, and it is true throughout the day's exercises, grave as well as gay. For while schools impose dry tasks, hard in proportion as they are uninteresting, because bearing no reference to childish tastes and aptitudes, the kindergarten, proceeding from close study of child-nature, follows and yet guides the child's own wish to learn, by presenting to him the facts or objects that naturally excite his curiosity; thus, instead of the passive attitude of the mere enforced learner, we find even the youngest active, and happy in their activity. Nor must we forget, that, in fostering natural curiosity, we are fostering the root of the love of knowledge, the growth of which, however humble, is a treasure to any life, and which may become with many the perennial source of the noblest enjoyments.

To sum up, then. The new method is more according to nature, and therefore more successful, and making the children happier.

It is more comprehensive, and therefore not only richer in present gain, but more durable in its effects, since education influences the future just in proportion to the hold it has taken on the whole development of mental and physical faculty, the germs of which lie undeveloped in the child.

It is more religious in its influence, not through dogmatic teaching nor direct religious services, but through the daily rejoicing in God's works; through the dawning sense of his presence and his ruling will in that wonderful outer world concerning which the child is so curious, and on which kindergarten-teaching is so continually fixing his attention. Thence gradually spring reverence and the sense of duty to that all-ruling power, and the vital roots of all religion are there.

Such being the superior claims of Froebel's method, it is most important to urge those claims upon all educational departments that include infant-schools, to induce them to adopt that method. The only serious difficulty is that of providing duly trained teachers, since, in the hands of ill-trained mistresses, the surface, play-aspect of the kindergarten becomes the whole; routine replaces principle; and a system, every step of which has been philosophically thought out, becomes a mechanism or a toy.

What is required is, that training-colleges should know that their infant-school teachers will be expected to be thoroughly conversant with the kindergarten theory and practice, and that employers should require a certificate from a competent authority, vouching for such training. With these precautions, difficulties will speedily vanish.

EMILY SHIRREFF.

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## *MR. ROMANES ON THE HIGHER EDUCATION OF WOMEN.*

AUTHORITIES of all sorts, theological, medical, and pedagogical, have lately been heard from on this subject as to the higher education of women, until it has been thought that nothing is left unsaid. But so eminent a scientist and psychologist as Mr. Romanes can always command a hearing; and in the course of a recent lecture at the Royal institution, on 'Mental differences between men and women,' he said not a little that directly interests educators. Mr. Romanes did not criticise the old-fashioned view as to the general mental inferiority of women, though he proceeded to uphold the more modern conclusion that women cannot be too highly educated. Ignorance, he said, is no longer one of those feminine qualities universally admired. It was not till the middle of the present century that any attempt was anywhere made to provide for the higher education of women. But now, whether we like it or not, the women's movement is upon us, and we must endeavor to guide the flood into the most beneficial channels. What are those channels? Assuredly not those that run directly athwart all the mental differences of men and women. No education will ever equalize this natural inequality of sex, and women as a *class* will never aspire to rival men. Yet, though inferior in mere strength, whether of body or of mind, in the truest grandeur of human nature, in the higher moral qualities, women are at least the equals of men, and for the full development of their nature they need education as much as men. More especially do they need an education in science. Thanks to high schools and colleges, he hoped that it would no longer be possible for a presumably educated woman to put to a lecturer such questions as these: "Tell me, is the cerebellum inside or outside the brain? Is your diagram of a jelly-fish intended

to illustrate the solar system? How have astronomers been so clever as to find out the names of the stars?" On the question of over-pressure, Mr. Romanes quoted the testimony of Mrs. Henry Sidgwick and Sir Spencer Wells, and stated that he had discovered but few cases of break-down. This proved, however, not that the system was perfect, but that English girls have marvellously vigorous constitutions. He then stated some grave abuses which had come to his knowledge, against which he desired to see public opinion directed. In some of the high schools, no check is placed on the ambition of young girls to distinguish themselves: there is no provision for bodily exercise, no play-ground, and the gymnasium, where there is one, is not used by the harder-worked students. A correspondent informed him that in one of the most famous high schools, girls usually began work at six, and worked ten or eleven hours a day: as examination approached, these hours were increased to fourteen, fifteen, sixteen, or even eighteen hours. The time fixed by the school time-table was, it is true, eight hours, but it was absolutely impossible for any girl to keep to this.

## *ENGLISH IN THE PREPARATORY SCHOOLS.*

THE changes that have taken place in recent years in the methods of language-study have done much to advance the cause of good learning. Every teacher owes a lasting debt to those who have wrought out and to some extent perfected these new and advanced methods. The debt of the teacher is, however, but a tithe of that due from those who have thus been spared laborious and well-nigh fruitless gropings through the labyrinths of a complex grammar and the blind bypaths of inexplicable idioms. Where the new methods have been wisely held in check by a recognition of the legitimate functions of grammatical study, the results have been in the main entirely satisfactory. Languages are now learned much more rapidly and easily than was the case a few years ago, and are thus the earlier brought into requisition as the means to some other and better end. Parrot-like knowledge of inflections and rules has ceased to be the goal of linguistic scholarship: the ability to use a language as a medium between the possessor and something to be sought in literature or life, is now more generally recognized as the purpose of such studies and the main reason for them.

It is somewhat astonishing, that, in view of all this, some more practical and rational method has not been adopted in the study of our own language as a vehicle of thought. In many of the colleges and universities there is, to be sure, a well-defined mania for philological research and an abnormal appetite for Anglo-Saxon roots. In our common schools this tendency is to some extent imitated by an unwearying attention to the minutiae of grammatical structure and the puzzles of syntactical forms. Of practice and humdrum drill in the use of English, there is little, in either school or college, in comparison with the importance of the subject and the needs of the students.

This lack of proper training in the use of English is due largely to two causes: 1°, the want of some efficient method in the teaching of English; and, 2°, the reluctance shown by our best teachers to engaging in this branch of work. Possibly the second reason may be the result of the first; possibly it is the result of some inherent prejudice, or some unconfessed doubts as to the dignity of this kind of work. As to these last reasons, it must be acknowledged, that, under the existing methods, the work is far from agreeable or inspiring to either teacher or taught, and no teacher can justly be blamed for preferring to avoid it whenever possible. The question may well be asked, however, whether this very reluctance is not one main cause why this important branch of work has been so long neglected, and whether, if our best-equipped and most earnest teachers were to apply themselves to a solution of the problem, it would not soon be solved as easily as were numerous other knotty problems in educational methods.

The writer has had occasion to test at college entrance examinations the familiarity of applicants with the forms and use of their mother-tongue. The results have been in the main unsatisfactory, and at times discouraging. The commonest grammatical forms seem entirely unfamiliar; a composition of a dozen sentences exhibits the most utter disregard of the simplest grammatical and rhetorical constructions. Students who construe Virgil with ease, who are on familiar terms with Euclid, and see no serious difficulties in Legendre, stumble and hesitate and fail in the use of their own language. To illustrate. At a recent examination the students were asked to decline the pronoun 'thou.' A large per cent of those examined failed utterly. Here are a few examples of how this inoffensive pronoun was treated:—

1. Thou, thine, thou; their, theirs, them.
2. Thou, yours, thou; same.
3. Thou, thine, thy; they, theirs, they.
4. Thou, thine, thee; they, theirs, them.

These four are fair examples of the whole list of failures. Nor must it be supposed that these young gentlemen had not been prepared in schools that stand fairly well. One was a graduate of a Massachusetts high school; one was a graduate of the preparatory department of one of the largest colleges in Ohio; two were prepared in New York high schools: the four taken together represent the educational system of three of the wealthiest, most populous, and most progressive states in the Union. In other simple grammatical forms a like ignorance was displayed; as, for instance, when one student declined Moses thus: —

Moses, Moses, Mosaic.

Such examples might be multiplied indefinitely, but these will suffice to prove how utterly inadequate is much of the preparatory instruction in the simple forms of our almost grammarless tongue.

When the work of writing English is considered, the results are almost equally barren. Scarcely an applicant for admission can write the simple essay required at the examination without some blunder in orthography, punctuation, capitalization, and, what is worst of all, grammatical accuracy. I say nothing of the faults in logical arrangement and rhetorical effectiveness. These qualities might, and indeed should, be taught in the preparatory schools; but I am sure every teacher of English in the colleges will be fully satisfied if students are sent up well equipped for writing English with grammatical correctness and some degree of ease. Such a foundation as this would enable the teacher to begin at once the work of aiding the student to acquire a clear and forcible style, instead of wasting time, as is now necessary, in doing the work of the preparatory schools.

The trouble seems to be that the preparatory schools do not, as a rule, give enough attention to the study of English. There is in the grammar schools a certain amount of grammatical drill and of analyzing and parsing. Much of this is good; much is worthless. So far as any useful end is concerned, the mere ability to analyze and parse an intricate English sentence counts for little. The ability to write a simple English sentence with accuracy and effectiveness would be of vastly greater advantage to the student. When the student attempts to pass an examination in any first-class college, this fact is made clearly evident. The main requirements at such a time are three, — first, the ability to recognize the few grammatical inflections that still persist in English, and to illustrate these, together with certain sentential constructions, by examples written at the examination; second, the ability to point out in sentences given at the examination the examples of false syntax and of offences against idiomatic English; third, the ability to write, on some familiar subject, a short composition which shall prove that the applicant possesses a reasonably full vocabulary, and is able to construct grammatical and idiomatic sentences and to combine them with ordinary skill. Of the three tests, the last named is by far the most important.

This brings us to a consideration of the work necessary to be done in the preparatory schools in order to fit students for college entrance examinations in English. In sketching this I shall not attempt to be exhaustive, but simply to indicate the main lines on which preparatory work ought to proceed.

1. There ought to be a thorough grounding of pupils in the inflections of English. This does not imply that pupils should be put through a severe course of training in all the niceties of grammar, but simply that the necessary inflections should be made perfectly familiar. For the accomplishment of this end, any one of the numerous 'methods' of language-study may be profitably employed; but it is my conviction that patient drill, accompanied by constant practice in the use of the various grammatical forms, is the best and simplest method. It cannot be too emphatically impressed upon the teacher that there ought, under any method, to be constant illustration, in actual work, of all difficult points in grammatical structure. It is especially important that the student be thoroughly drilled in the use of idiomatic English, and be taught to observe the distinction between closely related forms; as, for instance, 'shall' and 'will,' 'may' and 'can,' and other forms which persons ignorant of the idiom of the language are likely to confound.

2. There should be a reasonable amount of instruction in the simple intellectual qualities of English style. Dr. Abbott says, "Almost any English boy can be taught to write clearly, so far at least as clearness depends upon the arrangement of words. . . . [It] is a mere matter of adverbs, conjunctions, prepositions, and auxiliary verbs, placed and repeated according to definite rules."[1] Clearness is simply an intellectual quality, not depending, like strength and elegance, upon emotional or aesthetic gifts. Clearness, therefore, may easily be taught in the preparatory schools, and the principles and rules upon which it rests may be made a part of the intellectual equipment of the student. Beyond this it is useless to go. The study of rhetoric, in any proper sense of that term, is a waste of time, a source of confus-

[1] *How to write clearly*, pp. 5 and 6.

ion to students, and often an absolute hindrance to the acquisition of a good English style.

3. Throughout the entire course of a pupil's studies, from the time he can construct a simple sentence to the time he leaves the highest grade, there should be constant and rigorous drill in the writing of English. This part of the instruction is by far the most important, and is, at the same time, the part most frequently neglected. The writer has already published his views regarding the proper methods to be pursued in the teaching of English composition, and will not, therefore, go into that subject in this paper.[1] It is sufficient to say, in general terms, that all instruction in English composition should have constantly in view the immediate capabilities and needs of the students. It is no uncommon occurrence to have students in the lower classes of a college complain that they are asked to write upon subjects much simpler than those given in the high schools Students who have been stringing together a lot of senseless verbiage on 'Sunshine and shadow,' 'True greatness,' 'Heroism,' 'Honesty,' and the like, cannot see why they should be asked to descend to the trivial matters of every-day life, and to a discussion of subjects about which they know something. Yet one composition written on a familiar subject, composed with reasonable care, and then carefully and sympathetically criticised by the teacher, is worth a dozen perfunctory affairs, hurriedly written, upon subjects entirely beyond the experience or knowledge of the pupil. Careful and conscientious work in English composition would afford the best possible basis for future studies in all fields. With this should go, if possible, a reasonable familiarity with good writers, in order that the vocabulary of the pupil might be enlarged, and models of good and wholesome English be constantly presented.

In conclusion, it is only just to say that the charge of neglecting the proper study of English does not lie at the door of the preparatory schools alone. It is only within very recent years that English has begun to receive a fair share of attention in the colleges and universities. The tendency of modern education is toward the practical. It is beginning to be seen that the most useful weapon in the hands of any scholar is a thorough and practical knowledge of his own language. This conviction is arousing our colleges to better methods of work in this department, and is, in consequence, making necessary better preparation in the secondary schools. This preparation they can and should provide.

ERNEST W. HUFFCUT.

[1] See the *New England journal of education* for December and January.

## *SCANDINAVIAN STUDIES IN THE UNITED STATES.*

COMPLAINT has been made by many scholars that the study of the Scandinavian languages is almost entirely neglected in our colleges and universities, and that the general public is not alive to the importance of this study. Of the justice of the complaint there can be no doubt; but that the neglect is continually becoming less and less, it is my object to prove in this short paper. As no complete account of the Scandinavian movement in our colleges has ever been written, and as it is necessary, in order to arrive at a logical conclusion, that there should be a clear understanding of this movement, it may not be amiss if I preface my remarks with a brief sketch of the origin and development of Scandinavian studies in the United States. Though I have taken great pains to make the account complete, it is possible that some colleges may not receive the notice due them. Only college instruction will be discussed, the consideration of the purely literary side of the question being necessarily omitted.

To the University of the city of New York is due the credit of founding the first chair of the Scandinavian languages and literature. In 1858, Rev. Paul C. Sinding of Copenhagen was appointed the first professor in this department, and occupied the position, with honor to himself and the university, till his resignation in 1861. Professor Sinding's work had to do chiefly with Danish history and literature; and of the interest his work awakened in New York, we may judge from the fact that his 'History of Scandinavia' ran through seven editions in a few years. Since Professor Sinding's resignation, the chair has remained unoccupied.

In the same year that the study of the Scandinavian languages was abandoned in the University of the city of New York, the Norwegian Luther college was founded at Halfway Creek, Wis., and in 1862 was removed to Decorah, Io., where it is still located. It "owes its origin to the growing demand for educated men who could preach the Word of life to the rapidly increasing Norwegian population of this country." Luther college is, then, the first purely Scandinavian college in America. The instruction has always had a distinctively Norwegian tendency, and many of the text-books are printed in that language. The faculty and the students are almost entirely of Norwegian birth or parentage, and the Norwegian language and literature are studied through the whole college course.

On the opening of Cornell university in 1868, Willard Fiske was appointed professor of the North European languages, and instruction was

offered to students in Icelandic and Norwegian. In 1877, H. H. Boyesen was appointed assistant professor in the same department. Professor Boyesen resigned in 1880, and Professor Fiske in 1883, and since that time the department has been without a head.

In the same year that Cornell was founded, 1868, the example set by Luther college was followed by a Swedish colony in Illinois. The emigration from Sweden to this country had, in 1868, assumed such large proportions, that a Swedish theological seminary was established in Galesburg, Ill. Its object was the preparation of young men from the Methodist Episcopal church for the ministry. The seminary, which in 1882 was moved to Evanston, Ill., and united with the North-western university, is at present in a flourishing condition: "The course extends over three years, and the Swedish language and literature are studied throughout." In 1885 the Norwegian and Danish theological school was founded at the same university, and with similar aims. These two schools, together with Luther college, though quite unimportant from a philological stand-point, afford us ample proof of the practical side of the question as to the status of Scandinavian instruction in the United States.

In 1869, R. B. Anderson was appointed instructor in modern languages at the University of Wisconsin, offering a course in Icelandic, among others, — the first ever given in the United States. Six years later, Mr. Anderson was promoted to the position of professor of Scandinavian languages, which he continued to hold till his resignation in the autumn of 1883. During the remainder of that school-year, J. E. Olson taught a class of ten, in Icelandic. The following year, Mr. Olson was appointed instructor in the Scandinavian languages. At present, Mr. Olson has a class of thirteen members in Norse. Of the demand for instruction in this department, we may judge from the fact that there has been application from six students to begin a class in Icelandic. The Scandinavian languages were originally offered as optionals only; but soon after the creation of a separate department, Norse and Icelandic were offered as optionals in freshman and sophomore years, and as electives in junior, and, later still, also in senior years.

Next in order of time comes Columbia college, at present the only eastern college in which the Scandinavian languages can be studied. Instruction in Danish was first given by C. Sprague Smith, professor of modern languages during the winter of 1880–81, and in Swedish during the winter of 1882–83. In the fall of 1883, W. H. Carpenter, Ph.D., was appointed instructor in German, Icelandic, Danish, and Swedish, having classes that year, of three each, in Icelandic and Danish. During the last winter, Dr. Carpenter had classes in Icelandic and Danish; Professor Boyesen, one in Swedish; and Professor Smith delivered a course of lectures on Danish and Swedish literature, with reading of texts. For the present year, in addition to the preceding courses, Professor Boyesen offers a seminar in contemporary Norwegian and Danish literature, with lectures and conversation in Norwegian.

Still another western institution, the University of Nebraska, offers this year, for the first time, facilities for Scandinavian work; A. H. Edgren, Ph.D., a native-born Swede, professor of Sanscrit and modern languages, being the instructor.

Such is the list, as complete as possible, of the colleges in the United States which have at any time offered instruction in the Scandivavian languages. In connection with the subject, it may not be amiss to mention some courses of lectures on Scandinavian literature, other than academic, that have been delivered in this country. Prof. R. B. Anderson has lectured at the Peabody institute, Baltimore, and in different cities in Indiana; Professor Boyesen, before the Lowell institute, Boston, and at Columbia college, 1886. In 1881–82, Y. Theo. Dippold, Ph.D., lectured on the Niebelungen Lied in Boston and Cambridge: and in 1882, Dr. Carpenter delivered a course of twelve lectures on Old Norse literature at Johns Hopkins university.

The question as to the profit accruing from the study of the Scandinavian languages naturally presents itself. The well-worn arguments that have been used so much of late by the opponents and defenders of the old-fashioned system of Latin, Greek, and mathematics, may many of them be used with equal force in arguing this question. If the mental discipline furnished by the study of Icelandic be as great as that furnished by the study of Latin and Greek, if the culture of the old Norsemen give as profitable food for reflection as does the culture of the Greeks and Romans, then Icelandic wins the day, and gains a right to a place in every college course. This paper is intended mainly as an account of what has been done in the past, rather than an argument for what shall be done in the future, so that I shall not attempt a support of my position, when I make the claim that in each of these particulars Icelandic equals both Greek and Latin. I say nothing of the national significance of Icelandic studies to all who call themselves Anglo-Saxons, though, in the opinion of many, this alone is enough to offset any possible advantage the older tongues may possess. But I wish to say a few

words on the practical advantage of the study of the Scandinavian languages.

We of the east can scarce realize the part the Scandinavian plays in the west: books and newspapers are printed for him in his own language; ministers preach the gospel to him in his own tongue; his presence is felt everywhere, save in the university and the college. A population of 107,768 Scandinavians lives in Minnesota, and there is not a college in which the parent tongues of this great mass of people can be studied. But in order to give a clearer idea of the extent of the Scandinavian settlements in the west, I have taken a few tables from the U. S. census for 1880 (vol. i. pp. 465 and 261): —

| | Irish. | German. | English. | British American. | Scandinavian. |
|---|---|---|---|---|---|
| Minnesota......... | 25,942 | 66,592 | 9,598 | 29,631 | 107,768 |
| Wisconsin......... | 41,907 | 184,328 | 30,268 | 28,965 | 66,284 |
| Illinois............. | 117,343 | 235,786 | 60,012 | 34,043 | 65,414 |
| Iowa............... | 44,061 | 88,268 | 25,550 | 21,097 | 46,046 |

That is, in Minnesota the Scandinavians outnumber any other two foreign nationalities; in Wisconsin they are outnumbered by the Germans alone; in Iowa they also stand second, and in Illinois third, in the proportion of foreign-born inhabitants. If we compare the percentage of Scandinavians with that of French, we find still more startling figures: —

| | Scandinavian. | French. |
|---|---|---|
| 1850 | 0.80 | 2.41 |
| 1860 | 1.75 | 2.66 |
| 1870 | 4.31 | 2.09 |
| 1880 | 6.59 | 1.60 |

What the percentage of Scandinavians in this country will be in 1890, we can surmise from these figures. That it is increasing with as great rapidity as ever before, is very probable.

And it is this great people whose language and literature are considered of such slight importance that in only three of our great colleges is any attention paid to their study. There are more Scandinavians in the United States than French, and there is not a college in the country in which French is not studied. It is true that the Scandinavian languages are but little used on the continent; but no one can depreciate a language that counts among its great names H. C. Andersen, Adam Oehlenschläger, H. C. Oersted, Karl von Linné, Björnstjerne Björnsen, Ibsen and Jonas Lie. Such a language deserves study for its own merits.

Yet a word on the three Scandinavian theological schools. The only medium by which the non-English-speaking Scandinavians can be reached, and taught to become good citizens, is by men of their own race and tongue, who must be specially trained for this work. The three Scandinavian colleges that have been established for this purpose have done and are doing good work in their own way; but unfortunately their way is not our way; in fact, the views of the Scandinavian religious bodies are directly opposed to every thing distinctively American. Instead of trying to Americanize the Scandinavian youth of the west, these missionaries do all they can to keep their charges in their present condition. They do not teach them even to use the English language, but rather encourage, intentionally or not, the survival of a foreign language on American soil. The Scandinavian courses in our western colleges should be intended, not only to teach Norwegian and Swedish to Americans, but also English to Norwegians and Swedes. Those working as spiritual or secular teachers among the Scandinavians, should use their knowledge of the two tongues to increase and encourage the adoption of English as the natural means of communication of this great population of ours. It may seem inconsistent to advocate the study of a language as a means of its own destruction, but in actual working this plan will prove to be a success.

DANIEL KILHAM DODGE.

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A MAP of central Africa, based on the latest information, is now nearly ready, and will be published in an early number of *Science*. This will be the most accurate map of that region yet published in America, and will be the only American map which will enable readers to follow the journey of Stanley to the relief of the lost Egyptian army.

# SCIENCE.

FRIDAY, MAY 20, 1887.


## COMMENT AND CRITICISM.

WE MEET ALMOST DAILY with evidence of the increasing interest in folk-lore. There is, however, in some quarters a lack of specific knowledge as to the exact aims and methods of folk-lore studies, which must be removed before that general co-operation can be secured on which the success of these investigations is so largely dependent. Mr. Gomme, director of the English folk-lore society, is about to publish a book in order to present in simple and accessible form the needed information. This book will both supply collectors with suggestions as to what is required of them, and also form a scientific guide to the work of classification and comparison. Mr. Gomme points out the conditions of human life which would naturally give rise to religious beliefs, customs, and traditions, and then shows how the existence of such a thing as folk-lore is recognized when it is observed that there either exists or has existed, among the least cultured of the inhabitants of all the countries of modern Europe, a vast body of curious beliefs, customs, and narratives which are by tradition handed from generation to generation. These are essentially the property of the least-advanced portion of the community. They are neither supported nor recognized by the prevailing religion, by the established law, nor by the recorded history of the various countries. To this body of customs and beliefs there is constant addition made, arising from the explanation of newly observed phenomena by the uncultured portion of the community. The writer differentiates carefully savage custom and folk-lore, and says that the study of the former is necessary for the explanation of the latter. In not a few cases folk-lore is almost our only means of approaching the prehistoric period in the life of nations. Mr. Gomme offers as a definition of the science of folk-lore the following: it is "the comparison and identification of the survivals of archaic beliefs, customs, and traditions in modern ages." In this connection, it may be well to call attention to the letter, on another page, pleading for an American dialect society.



## THE AMERICAN ORIENTAL ASSOCIATION.

THE American oriental association met in annual session in the Athenaeum building, Boston, on Wednesday morning, May 11. In the absence of the president, Prof. W. D. Whitney, who, though considerably improved, has not yet, we are sorry to say, recovered his usual health, Vice-President Dr. A. Peabody presided. Considering the season fixed for the meeting, which is a particularly unfortunate one for those heavily engaged in university-work, the attendance was fair. Professor Lanman, in his report as secretary of the association, referred to the loss the society had incurred in the death of four of its members, — Professor Stenzler of Breslau (Germany); Dr. Alexander Wylie of London; Mr. H. C. Kingsley, treasurer of Yale college; and Prof. Charles Short of Columbia college. After speaking briefly of the services rendered by these gentlemen to the cause of learning, further remarks eulogizing the memory of the last named were made by Professors Thayer of Harvard, and Hall of the Metropolitan museum, New York.

The number of papers presented at the meeting was unusually large, a most welcome indication of the growth of oriental scholarship in this country. The reading of them, some merely in extract, consumed the greater part of the session, which lasted till late in the afternoon, with a short intermission at noon. Perhaps the most interesting of all was the first, by Dr. W. Hayes Ward, editor of the *Independent*, who offered a new and most happy interpretation of a scene depicted on a number of Babylonian seals which had hitherto baffled the ingenuity of scholars. On these seals we find a mythical figure in the act of ascending or resting his hands on what the late George Smith, the eminent Assyriologist, had taken to be a tower, but which Dr. Ward showed was a mountain. Behind the figure there is a portal out of which the personage ascending the mountain, or resting his hands upon the mountain-peaks, had evidently come. This scene, Dr. Ward proved, by a chain of arguments which left no doubt as to the correctness of his interpretation, is a symbolical representation of the rising of the sun, who at daybreak proceeds from the 'gate' behind which he was shut in during the night, and now climbs to the mountain-heights in order to illumine the world.

In the course of a discussion on this very suggestive paper, participated in by Professors Lyon

of Harvard college, and Jastrow of the University of Pennsylvania, further proofs were offered confirming, from certain references to the sunrise in the cuneiform texts, the mythological notions attributed by Dr. Ward to the Assyrians from a study of the seals in question.

Prof. Isaac Hall followed with an account of an important Syriac manuscript in the Union theological seminary of New York. Dr. Hall gave specimens of the manuscript, which will probably be published in the journal of the society.

Rev. Mr. Winslow had an interesting communication to make on the completion of an edition of the 'Book of the dead.' The publication of this, the most famous literary production of the ancient Egyptians, was undertaken at the instigation of the International congress of orientalists, under the superintendence of Prof. Eduard Naville of Geneva. An idea of the labor involved in this task may be gathered from the fact that the distinguished Swiss *savant* has been engaged in the preparation of it during the past twelve years. More than thirty papyri copies of the work were employed by him, besides the inscriptions on the walls at Thebes. As a result, two large folio volumes and one in quarto lie before us, containing the text, an elaborate introduction, and many thousands of variant readings. The old Egyptians carried the notion that this life was but a preparation for the next, to much further excess even than the Christians of the middle ages. Their entire philosophy and religion hinged around the one point of a future life; and hence it happens that their religious book *par excellence*, their Bible as we might say, was a 'Book of the dead,' or rather a 'Book *for* the dead,' containing an elaborate ceremonial and important instructions, all bearing directly upon death and the future world. The honors and distinctions which have been fairly showered upon Professor Naville since the completion of his enormous task, by the crowned heads of Europe and by learned societies, give proof of the great importance attached to this publication, which may indeed be said to mark an epoch in the history of Egyptology. At the suggestion of Mr. Winslow, the executive committee of the American oriental association adopted resolutions tendering its congratulations to Egyptologists and to Professor Naville, upon the appearance of the work.

Prof. D. G. Lyon announced a new publication in the department of Assyriology, which he believed to be as important to Assyriologists and Semitic scholars in general as the 'Book of the dead' was to Egyptologists. He referred to Prof. Friedrich Delitzsch's Assyrian dictionary, the first fascicule of which has just been issued. The work had been announced already ten years ago, since which time scholars have been most anxiously waiting for it. Professor Lyon dwelt upon the enormous labor involved in it and on its great importance; but to judge from the first part, which only embraces a small portion of the first letter, the dictionary, when completed, will be of an enormous size, and it is doubtful whether it can be finished in less than a decade, to say the least, that is, if Professor Delitzsch continues it on the large scale mapped out in this fascicule. There is certainly no one better qualified for this prodigious undertaking — which, when completed, will be a monument to German scholarship — than Delitzsch, who is acknowledged to be without a superior as an Assyrian scholar; and his courage in not shrinking from the difficulties it involves is in itself worthy of our highest admiration. Assyriology is perhaps the youngest of the sciences. Scarcely three generations have passed since the first attempt was made to decipher a line of cuneiform writing; but so rapid is the progress which has been made, more especially during the past two decades, that such an undertaking as that of Delitzsch has become at least a possibility.

The afternoon session was opened with a paper on 'Ikonomatic writing in Assyrian,' from Prof. Morris Jastrow, jun., which treated on the transition from picture-writing to phonetic writing in the Assyrian cuneiform system in connection with a theory advanced recently by Dr. D. G. Brinton of the University of Pennsylvania. The latter assumed an intermediate stage between the method of expressing thought by pictures, and purely phonetical writing, to which he gave the name of 'ikonomatic writing,' and which consisted in using pictures or symbols for the purpose of indicating a word or words similar or identical in *sound* to the object represented by the picture. We find this method, which is the principle upon which the ordinary rebus rests, very widely employed in the Egyptian, Chinese, and in Mexican pictography. Thus, in the first named, *nefer* is the name of a lute, and represented by a picture of that instrument. But *nefer*, by a coincidence of sound (but not of stem), also signifies door, conscript soldier, and colt. Accordingly, by the adoption of the ikonomatic device, the picture of the lute is employed to recall any of these three words, though generally with some determinative sign as an aid to the reader to enable him to know which of the various *nefers* is meant. In the Mexican and Mayan systems, as Dr. Brinton shows, this method is carried to much further excess, a remote similarity of sound being sufficient to warrant the use of a picture or symbol in this way.

Professor Jastrow gave quite a number of instances to prove the existence of this phenomenon. He also suggested, that, with the aid of the ikonomatic method, certain phases of the *polyphonic* character of the cuneiform signs — according to which the sign *bn*, for example, could also be read *pn*; the sign *ag*, also *ak* and *aḳ*; and many more similarly — could be more satisfactorily accounted for than by assuming, as has hitherto been done, that such an interchange of consonants is purely arbitrary. Professor Jastrow, in conclusion, dwelt upon the bearings which all this had on the question as to the origin of the cuneiform writing.

After a discussion on this paper by Professors Lyon, Ward, and Toy, the last named read an interesting paper on the famous Lokman, the Aesop of the Arabs. After presenting the various theories that have been brought forward about this very mysterious personage, Professor Toy developed a new one, which may perhaps be best described as the legendary hypothesis with some historical basis.

Dr. Richard Gottheil of Columbia college followed with a learned disquisition on Baheira, and presented a careful copy of one of the Baheira legends in Syriac, which he had made from a Berlin manuscript. Besides this, Dr. Gottheil gave descriptions of two Syriac manuscripts now in New York. Papers were also presented by Professor Avery, Rev. Jos. Chandler, Dr. Jackson of Columbia college, and three by Professor Hopkins of Bryn Mawr college, which were only read in abstract by Professor Lanman. Dr. Selah Merrill, late U.S. consul to Jerusalem, made some remarks on the discovery of the second wall of Jerusalem and the bearings this discovery had upon determining the site of the holy sepulchre.

Before adjourning, the society elected the following officers for the ensuing year: president, Prof. W. D. Whitney; vice-presidents, Professors Peabody and Saulsbury and Dr. Ward; recording secretary, Prof. D. G. Lyon; corresponding secretary, Prof. C. R. Lanman; executive committee, Professors Thayer and Hopkins, President Gilman of Johns Hopkins, Dr. Hall, and Mr. Cothiel. A number of new members were elected, and it was decided to hold the next meeting in October, at either New Haven or Baltimore.

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## *HEALTH MATTERS.*

A RARE DISEASE. — The ship Albana recently arrived in New York from Manila. Of her crew of nineteen, seventeen became ill on the voyage, four of whom died. Five of the patients were removed to the Long Island college hospital, where the diagnosis of beri-beri has been made. This disease has already been referred to in *Science* as a rare one, not occurring in this latitude except when imported from Japan, India, or other countries. It begins with fever, and pain in the loins and extremities: these are soon followed by paralysis of the lower then of the upper extremities, and sometimes extend to the muscles of the trunk, particularly those of respiration. The disease is in reality a multiple neuritis, involving especially the spinal nerves. The prognosis is usually considered grave, though the statistics of the Japanese navy would indicate that the mortality is not so great as is generally supposed. The cases that recover require considerable time, however, for the regeneration of the affected nerves. The medical director-general of the Japanese imperial navy has just published a report on this disease as it occurs in that branch of the service. In 1878 there were 1,485 cases, with 32 deaths; in 1879, 1,978 cases, with 57 deaths; during 1885 there were but 9 cases; and in 1886, only 3 cases, none of them being fatal. This remarkable result is attributed by the director to the improvement in the food furnished to the sailors. The few who contracted the disease in recent years had not had the benefit of the improved food.

SMALL-POX HOSPITALS. — One of the important subjects connected with sanitary administration is the location of small-pox hospitals in towns and cities. For the sake of the patients who are removed to these institutions, it is very essential that the distance which they are transported should be as little as possible; while, on the other hand, for the protection of the public, such hospitals should be situated so far from the inhabited portions of the town as not to be a factor in the spread of the disease. Mr. W. H. Power, a medical inspector of the English local government board, has given especial attention to this subject, and the evidence accumulated by him seems to indicate that a small-pox hospital in a town causes a greater incidence of small-pox in the vicinity. Within an area contained by a circle described three-quarters of a mile from the West Ham small-pox hospital, the death-rate from this disease was never less than twice, and sometimes even ten times, greater than the general rate; the number of cases showing a progressive decrease as the distance from the hospital increased. Mr. Power has studied the theories that the wind was a factor in this increase of cases near the hospital, and that the nurses and others were the channel of communication, but has found them inadequate to explain all the facts.

*NOTES AND NEWS.*

THE New England meteorological society has two special investigations on hand for the coming summer, in addition to its regular work of temperature and rainfall observation. The first special subject is thunder-storms in New England, now in its third year; the second is the sea-breeze on the eastern coast of Massachusetts, now undertaken for the first time. Volunteer observers are wanted in both investigations. Correspondence concerning thunder-storm observations should be addressed to O. N. Oswell, Cambridge, Mass.; concerning the sea-breeze, to L. G. Schultz, signal office, Boston, Mass. The considerable labor and expense that these studies involve is made possible to the society by assistance from the U. S. signal service, the Bache fund of the national academy, and the Harvard college observatory.

— Carl Gerold's Sohn, Vienna (New York, F. W. Christern), announces the publication of the 'Canon der Finsternisse,' by Th. Ritter von Oppolzer.

— D. O. Haynes & Co., Detroit, announce the publication of 'The cremation of the dead,' by Hugo Erichsen, M.D., honorary member of the Cremation society of Milan, Italy. It will contain an introduction by Sir T. Spencer Wells, and will treat of the question from an historical, sanitary, medico-legal, religious, aesthetic, and economical stand-point.

— The cornerstone of the Leland Stanford, jun., university, perhaps the most magnificently endowed institution of learning in the world, was laid at Palo Alto, Cal., May 13.

— In view of the renewed interest which the Central American states are now attracting, the article on Guatemala by W. T. Brigham, entitled 'An uncommercial republic,' which will appear in the June number of *Scribner's magazine*, will be especially timely and valuable.

— Mr. J. W. Graydon, late lieutenant U. S. navy, has recently been conducting some highly interesting experiments in Russia in the manipulation of explosives. He has been quite successful in mixing dynamite with ordinary gunpowder, obtaining greatly increased initial velocities without a corresponding increase in the pressure in the chamber of the gun. A valuable report upon the subject has been received at the navy department, which will soon be published.

— Mr. John Murray has in press a 'Dictionary of hymnology,' edited by the Rev. John Julian. The aim of the work is to trace the history of the Christian hymns of all ages, and especially of those now used in English-speaking countries. Biographical notices will be given of the authors of the hymns, besides historical articles on liturgical music generally.

— Chapman & Hall will publish the English edition of M. de Lesseps' reminiscences, extending over a period of forty years, in October next, simultaneously with its appearance in Paris. The work will also appear in German, in the first instance as a serial in one of the Berlin papers.

— G. P. Putnam's Sons make the following additional announcements for the spring season: 'The curability of insanity and the individualized treatment of the insane,' by John S. Butler, M.D., late physician and superintendent of the Connecticut retreat for the insane; and, in the 'Questions of the day' series, 'The fishery question,' a summary of its history and an analysis of the issues involved, together with a full bibliography of authorities to be consulted, and a map of the fishing-grounds, by Charles Isham.

— The *Critic* states that a memorial volume of the late Prof. E. L. Youmans will be prepared by his brother and sister, W. J. and Eliza A. Youmans, and that it will contain a number of manuscripts and important letters, including his correspondence with Darwin, Spencer, Mill, Huxley, Tyndall, Lubbock, Agassiz, and other distinguished persons.

— An octavo volume of nearly four hundred pages, with facsimiles of the Charter of 1650 of Harvard college and of the first page of the College Records, with engraved views of the college in 1821, and containing a full report of the celebration of the two hundred and fiftieth anniversary of the founding of the college, is nearly ready for publication by the college.

— The Ladies' health protective association of New York has six hundred members on its roll. It proposes to devote its energies during the present year to tenement-house reform, and to improvement in methods of street-cleaning.

— A case of fatal cocaine-poisoning is reported in Germany, in which the patient, a girl aged eleven years, died within two minutes after receiving a hypodermic injection under the skin of the arm, consisting of from four to twelve drops (the exact quantity being unknown) of a four-per-cent solution of the drug.

— Ernest Ingersoll, in the June number of *The American magazine*, will describe the 'Last remnant of frontier,' — a portion of our country near the north-western boundary, which was an unsettled and almost unexplored wilderness until penetrated by the Northern Pacific railroad.

— Prof. J. P. Mahaffy has in press a book on social life in Greece. It includes a review of the life and thought in all the Hellenistic kingdoms from the time of Alexander to the Roman conquest.

— The study of mathematical astronomy seems to attract so few college students in this country, that we have examined with some interest a pamphlet just received, a thesis on 'Cometary perturbations' presented by Prof. W. Hoover for the degree of Ph.D., University of Wooster, O. About half of the pamphlet is devoted to a general discourse on celestial mechanics, and the rest to deducing certain well-known formulae for cometary perturbations. Considerable work has no doubt been done in the study of Watson's 'Astronomy,' but we should have been glad to see the actual application of the formulae to some of our recent comets, following the example of students of astronomy at the German universities.

## LETTERS TO THE EDITOR.

****The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The Sonora earthquake.

IN this portion of the world, since the afternoon of the 3d, have been occurring a series of seismic phenomena, such as, so far as records or tradition show, never have happened here. The telegraphic (newspaper) reports possess the usual characteristics, — gross exaggeration with utter inaccuracy of detail. I am securing data to aid in making a more complete record of the phenomena, and make this merely a preliminary note.

The earthquake struck this town at 3.06 P.M. local time, which, reduced to standard, gives 2.48. Probably the best description will be an account of my own sensations. I had just noted the time, when I heard a rumble such as made by heavy ore-teams in passing. This noise increased; and the building, a two-story adobe, began to shake gently, then more violently. By this time it seemed to me to be a severe whirlwind, such as frequently occurs here at this season of the year. The shaking and the noise increasing, I went to the front of the building, some fifty feet, and looked out. Then it began to dawn upon me that something of a serious nature was taking place, judging from the looks of the crowd on the streets. I then ran back to the place whence I had started, picked up a child, and made my way to the street. When the open air was reached, the noise was like a continuous roll of heavy firing, with occasional short peals like a sharp clap of thunder. This ceasing, I looked at my watch, and found that from the time I had noticed the first rumble until the end, had been about 1.75 minutes. Allowing ten seconds for error, leaves 1.65. Of this time, the duration of the severe shaking could not have been over ten seconds; the moderately severe, about twenty; and the trembling, the balance of the time. Judging by the movement of some glasses and statuettes on my desk, the general direction of the shock was from south-west to north-east.

The amount of damage done, so far as I can learn, is trifling. No building of any stability has been damaged at all; neither has any one been injured or killed. Persons riding or driving were unaware that any thing was happening. In the Sulphur Spring valley, about twenty-five miles east of here, some fissures occurred in the bed of an old stream, and water spurted out to a small but varying height and in considerable quantity. These streams continued flowing for two or three days, but at present all save two are dry. These seem to be permanent, and are running a small amount of water at ordinary temperature. I have not seen them, and my account is derived from the owner. I may mention as an amusing fact, that, in less than an hour after they broke out, they were taken up and located under the water-laws of the United States.

Succeeding the shocks, mountain fires were noticed on many of the ranges. This gave rise to the reports of volcanic action, which may safely be set down as pure imagination. No phenomenon resembling eruptive disturbance, so far as I can now ascertain, has taken place in any part of the section disturbed.

At the time of the first and severe shock, owing to the vibration and the rolling of bowlders down the mountain-sides, large clouds of dust arose: this, with the noise, caused many who saw the phenomenon to think that the cause was eruptive. The fires, with only two exceptions that I now know of, were burning before the shock. Of these it is possible that they were not noticed prior to this, or, what in my opinion is not improbable, falling bowlders ignited the timber. This point I will try to clear up. The San Pedro River, a small stream nine miles west of here, is reported to have a slight increase of water. This is diminishing rapidly.

The railroad-track of the Atchison, Topeka, and Santa Fé road, at a point where it ran in an east and west direction, was bent 4½ inches out of line, the convexity looking south. The bend was about three hundred feet in length. Succeeding the severe shock during the following forty-eight hours, marked and noticeable tremors occurred about every half-hour. These were of greater or less severity, but none approached the first. Had instruments been here to record the motion, no doubt they would have demonstrated a continual vibration.

The heaviest shock, since the first, occurred last night about 9.30. One ludicrous incident was that of an acquaintance, who, while driving along a mountain-road, noticed large-sized bowlders begin to start down the mountain towards him. He became much excited, took his rifle, and alighted with the intention of seeking vengeance on the perpetrators of the outrage. The falling of some immense bowlders weighing hundreds of tons just then, changed his mind: he will not now hunt the author. Men working at a depth of six hundred feet felt the vibrations severely. Some said they became sick, and all said that the bottom of the drifts or shaft seemed to rise. Men working at one hundred and fifty feet did not notice it so much. One crew of

men at that depth did not know of it at all until they came out of the mine. No damage was done to any of the mines. The deepest workings are seven hundred feet.

As an interesting coincidence, I will mention, that, while in the Salt River valley two weeks ago, I was informed by Mr. Frank Cushing the ethnologist, who is making extensive excavations in the old ruins abounding there, that one of the principal if not the main cause of the abandonment of so populous and fertile a valley was earthquakes. As there are no records of any occurring since that time, Mr. Cushing may take the blame of suggesting this. I am without trustworthy information concerning the extent of the disturbance; but, as near as I can judge, it is about twelve hundred miles long by six hundred in width. There were no magnetic disturbances whatever.

Since writing the above, additional information has come to hand that modifies my opinion somewhat as to the extent and character of this disturbance. From Señor Campi and Mr. L. A. Richards of Sonora, I am informed that the disturbance in their section of the country was profound. They are living in Sonora, Mexico, about two hundred miles south of here, in the Fronteras valley. The first shock was felt there about three o'clock on May 3. In Fronteras ten houses were thrown down, one child was killed, and one woman fatally injured. In Cumpas, still farther south, four houses were destroyed, no one hurt. Extending the entire length of the valley, over one hundred miles, are fissures varying in width from a few inches to ten feet, having a northerly and southerly direction. From this information it is safe to conclude that the centre or area of worst vibration lies to the south of this and in Mexico. It will take at least a month to secure requisite information to make a report. That country is sparsely settled, with no telegraphic communication or railroads; nothing but wagon-roads, and those very poor. These gentlemen confirm the report of mountain fires immediately succeeding the shock. They think that the entire valley has subsided a little.

Also at the San Bernardino ranch, ninety miles south-east of here, all the buildings on the place were thrown down. They were built of adobe, and were substantial. This place lies within a short distance of some extinct craters, and is in the centre of an ancient volcanic belt.

Later reports make the disturbance in Mexico, about the same region mentioned above, as very destructive. As some lack verification, I defer reporting them until further word is received.

G. E. GOODFELLOW.

Tombstone, A. T., May 7.

### Defence of a civil academy.

The editorial columns of *Science* (May 13, 1887) are guilty of a manifest inconsistency upon the subject of state aid to the higher education. In your first column you condemn, in strong language, my idea of a civil academy at Washington, proposed in the circular of information, No. 1, 1887, bureau of education. In your fifth column you quote, with evident respect, Professor Jowett's views upon government aid to the university colleges of England. You even give publicity to this statement, without dissent: "No principle of political economy forbids the application of public money to the education of those who cannot afford to help themselves. Such an expenditure is really one of the best affairs of business in which a nation can engage." You venture to add that there is some prospect of Dr. Jowett's plea being effective. While it is not to be expected, in the present transitional stage of political economy and in the present condition of American politics, that all men should agree upon the necessity of education and science for good government, it is at least fair to demand some degree of consistency in a scientific journal.

Furthermore, I beg to differ from your opinion that this country is dotted with colleges where any young man may obtain all needful political education. If there is one thing needful at the present time in our American civic life, it is instruction in the art of administration. Over against your statement, let me place that of Mr. Dorman B. Eaton, recently expressed before the graduate students of history and politics in the Johns Hopkins university. From his practical connection with the civil-service commission, he may be presumed to know what he was saying. He said there was not a single institution in the United States where a man could learn what reformers wish to know about scientific methods of administration. Mr. Eaton may have ignored one or two oases of political training in this country; but every fair-minded man must admit, upon reflection, that American colleges do not teach this subject. You say it is well enough to train men for the army and navy, but intimate that our prospective civil servants can acquire adequate training "from any village school, and will not ask the government for alms that they may the later live from the public purse." No, our public men sometimes try to carry the entire bag, and distribute public bounty, or 'spoils,' to all their friends and constituents. They even vote in state legislatures for free text-books in common schools, and allow publishers to corrupt school-committees. Who teaches 'the homely proverbs of Poor Richard' to our local politicians nowadays, and who ever heard of the A B C of finance in 'any village school'? Do the spoils system and the history of American legislation, municipal, state, and national, indicate that our public servants have been well grounded in common honesty and *good* political economy? Before pronouncing judgment upon my suggestion as *poor* economy, you might profitably compare the cost of scientific administration with the present American system. Materials for the comparison may be found in the civil lists of various European countries.

My plea was for a civil-service academy, recruited by congressional appointment from men pronounced fit by our state universities. It was for a civic West Point. It was for the political training of able and mature young men in a political environment, in the capital of the nation. It was a plea for opening the channel of communication between our universities and public life, between political science and political praxis. I proposed that the highest education in the country and the most expert talent now in the service of the government should both be made tributary to the training of picked young men for a term of two years, partly by lectures, and more especially by practical work in government bureaus, after the manner of the seminary connected with the Statistical bureau in Berlin, which is recruited by university graduates of the highest ability.

This is no visionary, unpractical scheme. It has been realized, in one form or another, by most European states. The idea is slowly evolving in connection with our own government departments. The state department has in training a body of consular clerks. The navy details men for special study in Greenwich, Paris, and Baltimore. The war department has also allowed men to study in Baltimore laboratories. Mr. Trenholm, the comptroller of the currency, says he is going to select the brightest young men he can find, and train them for bank-examiners. The idea is in the air at Washington, and it will sooner or later find a lodgement in every department and bureau. You will probably hear of it next week from Col. Carroll D. Wright, commissioner of the bureau of labor, in his address on the study of statistics in American colleges, before the American economic association, at its meeting in Cambridge, May 24, 1887. Statistical science, finance, forestry, agrarian economy, consular duties, and diplomacy have never yet been taught, to any considerable extent, in our American schools and colleges. You might as well expect a corps of military engineers to evolve from the state militia as to suppose that the higher arts of administration can be acquired by either school or college training. Administration is one of the highest branches of scientific politics, and it seems to me that *Science* ought to recognize the fact. As to the diplomatic service, a Boston gentleman, who has had much experience in this connection, writes, "I have had a good deal to do with some of our diplomatic servants in Europe, and have often been put to the blush for their incompetency to perform their duties. Why should we not have a diplomatic service like other nations, and why should we not have a national institution in which the students should be taught, among other things, diplomacy?"

HERBERT B. ADAMS.

Johns Hopkins univ., May 16.

## The occurrence of similar inventions in areas widely apart.

The leading idea of Otis T. Mason's writings on ethnology is his attempt to classify human inventions and other ethnological phenomena in the light of biological specimens. "They may be divided into families, genera, and species. They may be studied in their several ontogenies (that is, we may watch the unfolding of each individual thing from its raw material to its finished production). They may be regarded as the products of specific evolution out of natural objects serving human wants and up to the most delicate machine performing the same function. They may be modified by their relationship, one to another, in sets, outfits, apparatus, just as the insect and flower are co-ordinately transformed. They observe the law of change under environment and geographical distribution." This method of research is founded on the hypothesis that a connection of some kind exists between ethnological phenomena of people widely apart. Professor Mason is of this opinion, and expresses it as follows: "Anthropologists assign similar inventions observed in different parts of the world to one of the following causes: 1. The migration of a certain race of people who made the invention. 2. The migration of ideas — that is, an invention may be made by a certain race or people and taught or loaned to peoples far removed in time and place. 3. In human culture, as in nature elsewhere, like causes produce like effects. Under the same stress and resources the same inventions will arise." From this stand-point Professor Mason has arranged the ethnological collections of the national museum according to objects, not according to the tribes to whom they belong, in order to show the different species of throwing-sticks, basketry, bows, etc.

We cannot agree with the leading principles of Professor Mason's ethnological researches. In his enumeration of causes of similar inventions, one is omitted, which overthrows the whole system: unlike causes produce like effects. It is of very rare occurrence that the existence of like causes for similar inventions can be proved, as the elements affecting the human mind are so complicated; and their influence is so utterly unknown, that an attempt to find like causes must fail, or will be a vague hypothesis. On the contrary, the development of similar ethnological phenomena from unlike causes is far more probable, and due to the intricacy of the acting causes. As far as inventions are concerned, the disposition of men to act suitably is the only general cause; but this is so general, that it cannot be made the foundation of a system of inventions.

But from still another point of view we cannot consider Professor Mason's method a progress of ethnological researches. In regarding the ethnological phenomenon as a biological specimen, and trying to classify it, he introduces the rigid abstractions species, genus, and family into ethnology, the true meaning of which it took so long to understand. It is only since the development of the evolutional theory that it became clear that the object of study is the individual, not abstractions from the individual under observation. We have to study each ethnological specimen individually in its history and in its medium, and this is the important meaning of the 'geographical province' which is so frequently emphasized by A. Bastian. By regarding a single implement outside of its surroundings, outside of other inventions of the people to whom it belongs, and outside of other phenomena affecting that people and its productions, we cannot understand its meaning. The only fact that a collection of implements used for the same purpose, or made of the same material, teaches, is, that man in different parts of the earth has made similar inventions, while, on the other hand, a collection representing the life of one tribe enables us to understand the single specimen far better. Our objection to Mason's idea is, that classification is not explanation.

His method, as far as applied to objects which have a close connection with each other, is very good. The collection of moon-shaped Eskimo knives or labrets from North-west America has given us great pleasure, and enables us to trace the distribution of those implements; but even they do not fully answer the purpose of ethnological collections. Besides these, we want a collection arranged according to tribes, in order to teach the peculiar style of each group. The art and characteristic style of a people can be understood only by studying its productions as a whole. In the collections of the national museum the marked character of the North-west American tribes is almost lost, because the objects are scattered in different parts of the building, and are exhibited among those from other tribes.

Another instance will show that the arrangement

of similar implements does not serve the purpose of ethnological collections. From a collection of string instruments, flutes, or drums of 'savage' tribes and the modern orchestra, we cannot derive any conclusion but that similar means have been applied by all peoples to make music. The character of their music, the only object worth studying, which determines the form of the instruments, cannot be understood from the single instrument, but requires a complete collection of the single tribe. Here, however, it can be seen that each ethnological collection affords only very fragmentary instruction; that its real use is only to illustrate descriptions of the tribes. For a study of native art and its development, they are indispensable. For this purpose, duplicates, of which the superficial visitor of ethnological museums frequently complains, are absolutely necessary. They are the only means of determining what is characteristic of a tribe, and what is merely incidental.

Mason's method takes a place in ethnology similar to the former 'comparing method' in geography. A mere comparison of forms cannot lead to useful results, though it may be a successful method of *finding* problems that will further the progress of science. The thorough study must refer to the history and development of the individual form, and hence proceed to more general phenomena.

DR. FRANZ BOAS.

New York, May 13.

### Explosions in coal-mines.

In *Science* for May 6, is a review of the report of the Atkinsons on explosions in coal-mines. One or two statements therein seem to convey an erroneous impression; notably, "At the working faces the dust is not often a serious evil," and, under remedial measures, that "watering the roadways . . . is of little avail as a means of preventing explosions, since the upper dust in every instance is left undisturbed."

The first quotation is manifestly an error, as dust-explosions can generally be traced to the firing of the dust in the working faces by blown-out shots, especially when such shots react against a tamping of coal-slack. In the main body of the article the argument seems to be in favor of the dust in the gangways as the proximate cause of explosion, while it is but the ultimate cause. The dust formed by cutting or breaking down coal has very little to do with the formation of an explosive mixture, because it is not impalpable enough. As the article states, the gangway dust is ground to an impalpable powder, and carried away by the air; but such dust would do little harm, did the return currents through the working places not lose their velocity and deposit this impalpable dust on the walls nearest the face, from the fact that the ventilating currents must sweep the faces free from smoke and foul air. In the only known American accident due to dust (the Pocahontas explosion), there was little evidence of initial explosive force along the gangways, but in the headings of dusty rooms there occurred a series of explosions that made the fact evident that fine dust in headings is the cause of so many accidents.

The Prussian commission showed that a certain percentage of volatile matter was necessary for an explosive dust, and experiments made at this place show that the temperature at which coals give up their volatile ingredients vary; so that a blown-out shot, from a hole tamped with coal-slack, projected into a chamber whose walls are thickly powdered with fine dust, will have its flame prolonged by the dust of the tamping and the gases from that dust, and the case will be analogous to those stated by Professor Abel, where a small admixture of gas would render inert dusts explosive.

Finally, it has been found that watering dusty roads with brine at intervals of thirty days made the dusts less ready to rise in clouds, and stopped the formation of 'upper dust.' But the best way of all is to keep the roads clean by ballasting them at the outset with rock or shale free from carbon, and by picking off the coal shaken from cars. In the Pocahontas accident the explosive phenomena ceased as soon as the current left the region where the roads were ballasted with coal-slack, and the action in the parts ballasted with slate was a simple burning of the dust brought there by the current. In spite of an explosive coal, the parts of that mine last mentioned were comparatively free from dust, and the props nearly all standing, while in the former portion there was explosive action in nearly every working place, so that the tracks were torn to pieces and the props down. In mines of this nature, black powder should be avoided, and the coal should be wedged, or, if the coal must be shattered, the dynamite cartridge with water casing can be used with impunity.

EDWARD H. WILLIAMS, Jr.

Lehigh univ., May 13.

### Water-filtration.

It may be of interest to notice in connection with your note on the results of Dr. Swarts's experiments on the relation of water-filtration to bacterial development, that Dr. J. H. M. Munro, in his experiments on the nitrification of well-waters, discovered and called attention to the fact that a well-water nitrified more rapidly after filtration through a Lipscombe's charcoal filter in common use, than did an unfiltered sample of the same water (*Journ. chem. soc.*, 1886, p. 666).

WILLIAM FREAR.

State college, Penn., May 16.

The fact that an increase of micro-organisms would take place in a filter constantly in use, had already been demonstrated by Percy Frankland, England, and by several German investigators.

The series of experiments conducted by myself differed from theirs merely in using the filters found upon the local market, and in imitating as near as possible their use in ordinary family water-supply; cleansing in the first use by allowing the supply to pass through the filter to wash away detritus, and not by absolute sterilization, as in usual laboratory experiments. The filters used were variously packed with bone or animal charcoal, quartz, the two combined in layers, felt, and unglazed porcelain.

Such a result as that spoken of in *Science* (ix, p. 457) is to be expected, when we consider the mechanical work we have to do in filtration; for no amount of chemical change is expected except in Clarke's process, which is precipitation, not filtration. If the filter is a successful strainer, the suspended matters within the water are held back upon the surface of the strainer *and within* the interstices of the filtering media, whether it be gauze, asbestos, iron shavings, felt, or porcelain. The great mistake seems to be in believing, that by use of a current of water, or by removing the media and scrubbing the surface with a brush, all the filtrate is removed, for-

getting the amount held within the interstices of the media.

In those filters in which the mechanism or media is reversed for cleansing, the organic matter upon which the microbes are feeding and multiplying, and which has become attached to the walls of the spaces of the filtering media, are not removed, any more than the greenish scum is removed from the stones in a rapidly flowing brook: on the contrary, so tenacious is this material, that it forms in strings and streamers pointing with the current.

As is well known, commencing at the set bowl in a dwelling-house, a deposit forms upon the sides of the waste-pipe, continues downward, adhering to the sides of the trap and continuing to the drain-pipe and sewer, till it reaches the point of delivery. This deposit is, of course, composed of the wastes which have been thrown into the bowl, and which is fully charged with organisms whose function is to destroy and assist in nature's retrograde metamorphosis. The strongest flushing of this pipe does not remove the slime from its sides: how, then, can a retarded pressure of water wash away the organic matter adhering to the sides of our meshes of felt and our granules of quartz and charcoal?

The number of microbes in a given sample of water serving to render it harmful, has not been actually determined, any more than a specimen can be condemned for the amount of albuminoid, ammonia, or chlorine alone which it contains; still a water containing over a thousand microbes or colonies to the cubic centimetre of water is the highest limit consistent with purity in drinking-water. A water which contains fifty bacteria to the cubic centimetre before filtration will increase to over a thousand in seven days' use, no matter how much care is taken to cleanse the filter short of absolute sterilization.

The point of danger, however, lies in the fact that the two diseases which are communicable by ingestion into the alimentary canal of the excrement from them (typhoid-fever and cholera) are the ones which are liable to find their way into drinking-water from contamination by sewage finding its way into river and well supplies.

I am at present conducting experiments to determine how rapidly the germs of typhoid may increase within filters in the presence of sterilized water and in presence of the bacteria of drinking-water.

GARDNER T. SWARTS.

## An American dialect society.

Is it possible to establish such an institution? It is certainly time. Year after year the older districts of the United States and Canada are getting less and less distinguished by those peculiarities in their vernacular which to the student of history and philology are of the utmost interest. Public schools, many newspapers, cheap books, a taste for reading, a notion that 'old-time' ways and dialect are not 'elegant,' and, above all, the more constant communication between different parts of the country, are doing much to tone down the people of the United States to what, from the philologist's point of view, is one dead level. In time the mountaineers of Tennessee and the hill country of the Carolinas, the 'crackers' of Georgia, and the picturesquely talking folk of the Arkansas bottoms and the lower Mississippi, will have lost many of their present peculiarities of speech. Even the New-Englanders, I am told (for I have not lived in America for more than twenty years), are fast abandoning many of those dialectic peculiarities which to a philologist are so suggestive. Even the Virginians, since they have gone into the great world, are no longer so readily 'berayed' by their speech. Now, therefore, is the time to collect vocabularies of these local dialects, with specimens gleaned from printed works illustrating the use of any particular word. Books, almanacs, election-addresses, and a host of similar ephemeral literature, might be gathered and deposited in the national library. Mr. Cable, by his novels, has done much to preserve the quaint Creole Louisianian speech; Mr. Johnston has in the same way done as much for the Georgian dialect; Miss Murfree for the Tennessee mountaineers; Mr. Page for the Virginians; a host of writers, *imprimis* Mr. Lowell, for the New-Englanders; and, not to go over the long roll of writers in American dialects, Mr. Harris has shown us what a wealth of folk-lore and folk-speech there is to be garnered among the southern negroes. But the next generation will have no such easy task as the present one. Even in slow-going England the Folk-lore society and the English dialect society came quite late enough into the field, and found that in a few years more the school boards and the desire to be 'genteel' would have effectually effaced those old-world differences of tongue which even in 1598, when Puttenham was writing his 'Arte of English poesie,' had begun to be blurred. Already many a precious relic of the past has been forever lost, and we can only be thankful that so much has been preserved. In America — I speak, of course, of the old colonial sections — there still linger peculiarities, and even bits of folk-lore, which have vanished out of the districts in the mother-countries from which the immigrants came. Now, therefore, is the time for snatching up what still remains, and I question whether there are not in the United States and in lower Canada quite as many dialects as there are in England. The 'Pennsylvania Dutchman' has even yet peculiarities in speech easily detected by those who know them, and there is scarcely an old state of the Union of which the same could not be said.

R. B.

Streatham, London, Eng., April 30.

## Geography-teaching.

The article by Inspector Jolly, on 'Realistic and dramatic methods in teaching geography,' to which you refer in your number of May 12, is without doubt a clear and full statement of the various points of weakness in such work, and of the remedies to be applied.

He urges a greater use of material and a more rational and scientific method. On these two points hangs the whole matter. Every one who has ever taught geography knows that nothing can be done without an abundance of aids in the way of objects, pictures, models, globes, maps, etc.; and every one who has taught in the United States knows that objects, pictures, models, globes, and good maps are there very, very few.

A full assortment is not found in one single school; a good assortment, only in a small number, where men of wide views have had charge. There are two reasons for this condition of things, — one, that few schools take enough interest in the subject to procure what material can easily be had; the other,

which partly accounts for the first, that there is nowhere in this country any place where even an idea of what material there is, can be got. In short, we do not have good material, because we do not know what good material is.

Supposing, however, that all schools were fully equipped in that line, there arises the other issue, have we teachers who could properly use the material, and in a scientific method produce in a pupil's mind that happy result so much talked of, so seldom seen? To this there are two answers, — yes and no. The first applies to teachers who would instruct the elementary classes.

If the average normal-school graduate had been properly trained by a broad-minded instructor in the use of material, and made thoroughly acquainted with the general facts of geography and its brother-studies, botany, zoölogy, ethnology, etc., such graduate would be, in the primary and intermediate schools, fully competent to do the work. But in higher work, where scientific deduction should be employed, where a wide and deep knowledge on the part of the instructor is demanded, the average normal graduates could not do the work. They are not mature enough, they do not know enough. I mean what I say, when I say they do not know enough.

They are not to blame. Geography needs a fund of general information and of special information as wide as a church-door and as deep as a well. No teacher whose specialty is not geography ever acquires it, and we have almost none who are devoted to this one subject. The class-room system forbids.

This upper stage of the work needs the mature strength of college graduates, and of college graduates devoted to geography. Of such there are almost none.

In fact, I know of a vigorous attempt recently made to find one, which ended in failure. Germany alone provides her schools with such men. There one must go to know the whole subject.

These two points, then, being stated, there appears to me but one way out. The best mode of reforming the lower-grade teaching is available. Material should be brought from the centres of geographical interest abroad, and the school public made aware of the resources to be had. Then there might be an advance there.

As to teachers for the upper grade of geography, until our colleges take a higher stand in regard to requirements in the subject, and provide professors who can teach the subject so that their students will have a real, living interest in the matter when they leave college, — until then we must wait, content with the few men who, of their own accord, work up the subject from a professional stand-point, and in their own circle of influence do really teach geography.

C. H. LEETE.

New York, May 14.

## Queries.

4. TEST FOR OLEOMARGARINE. — Please give a simple test for distinguishing butter from oleomargarine. — P.

[There is no simple test for distinguishing butter from oleomargarine, — a test which at the same time is simple and accurate, and which settles the question beyond doubt. A great many tests have been proposed from time to time, but they either require special skill and apparatus for their execution, or they are of very little value, failing to accomplish what they promise. The following test will perhaps be found of some use: a cotton wick is saturated with melted fat from the butter to be tested; the wick is lighted, allowed to burn for a short time, and then blown out. If the sample is oleomargarine or adulterated butter, an offensive odor, as of an extinguished tallow candle, will be perceived. It is to be noted, however, that pure butter which has stood for a long time will give the same smell. Another test is the following, devised by J. Horsley: a little of the clear, melted fat is poured into a small test-tube; the fat is dissolved in common sulphuric ether, and about thirty drops of spirit of wine are then added; if natural butter, a white precipitate will be formed; if artificial butter, the solution will remain clear. While these tests may sometimes prove efficient, they will often leave the point unsettled. Other tests proposed for discrimination between oleomargarine and natural butter may be of more value, but, calling for special apparatus and solvents, they can hardly be called practical or simple. Chemical analysis of suspected samples will decide the question beyond dispute: outside of the chemical laboratory we have as yet no practical means of fully ascertaining whether a sample of butter is natural or artificial. — ED.]

5. A SQUARE PUZZLE. — Having a rectangle nine by sixteen, is it possible by one cut to make two figures which joined shall make a square twelve by twelve? — Z.

# SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 20, 1887.

## *ABSTRACT OF THE RESULTS OF THE INVESTIGATION OF THE CHARLESTON EARTHQUAKE.*[1]

THE amount of information now in possession of the U. S. geological survey, relating to the Charleston earthquake, is very much larger than any of similar nature ever before collected relating to any one earthquake. The number of localities reported exceeds sixteen hundred. The sources of information are as follows: 1°, we are deeply indebted to the U.S. signal service for furnishing us the reports of their observers; and, 2°, equally so to the Lighthouse board, which has obtained and forwarded to us the reports of keepers of all lighthouses from Massachusetts to Louisiana and upon the Great Lakes; 3°, to the Western union telegraph company, which instructed its division superintendents to collate and transmit many valuable reports; 4°, to the Associated press, which has given us access to the full despatches (with transcripts thereof) which were sent over the wires centring at Washington during the week following the earthquake; 5°, to geologists and weather-bureaus of several states, who have kindly exerted themselves in this matter, and collected much important information; 6°, to a considerable number of scientific gentlemen who have distributed for us our circular letters of inquiry in special districts, notably, Profs. W. M. Davis, C. G. Rockwood, J. P. Lesley, T. C. Mendenhall, and Messrs. W. R. Barnes of Kentucky and Earle Sloan of South Carolina; 7°, to a large number of postmasters in the eastern, central, and southern states; and, finally, to hundreds of miscellaneous correspondents throughout the country.

In collecting this information, a printed list of questions was prepared. This practice has been resorted to in Europe and in Japan with considerable success, and the questions which have been devised for distribution in those countries have been prepared with great skill by some of the ablest investigators of earthquakes. Prof. C. G. Rockwood of Princeton has also been in the habit of distributing formal questions of this character in this country whenever apprised by the newspapers of a notable shock. Availing ourselves of his advice and assistance, questions prepared by him were printed and widely distributed. They were much fewer and more simple than those employed in Europe, because European investigators depend almost wholly upon the educated classes to answer them, while in this country the uneducated but intelligent and practical classes of the people must be the main reliance. These questions were designed to elicit information, 1°, as to whether the earthquake was felt; 2°, the time of its occurrence; 3°, how long it continued; 4°, whether accompanied by sounds; 5°, the number of shocks; 6°, general characteristics which would serve as a measure of its intensity, and indicate the kind and direction of motion.

It is to be observed that the only information to be hoped for, which can have even a roughly approximate accuracy, is the time of transit of the shock. The degree of approximation in the time data actually obtained will be adverted to later. Special effort was made to obtain information as to the relative intensity of the shocks in all parts of the country. At the very outset a serious difficulty presents itself. In the estimates of intensities there is no absolute measure. What is really desired is some reliable indication which shall serve as a measure of the amount of energy in any given portion of the wave of disturbance as it passes each locality. The means of reaching even a provisional judgment are very indirect, and qualified by a considerable amount of uncertainty. To estimate the force of a shock, we have no better means than by examining its effects upon buildings, upon the soil, upon all kinds of loose objects, and upon the fears, actions, and sensations of people who feel it. In view of the precise methods which modern science brings to bear upon other lines of physical research, all this seems crude and barbarous to the last degree. But we have no other resource. Even if it were possible to obtain strictly comparative results from such facts, and decide with confidence the relative measure of intensity which should be assigned to each locality, we should have gained measures only of a series of local surface intensities, and not of the real energy of the deeply seated wave which is the proximate cause of the surface phenomena. Notwithstanding the indirect bearing of the facts upon the real quantities we seek to ascertain, and their apparently confused and distantly related character, they give better results than might have been supposed. When taken in

[1] Read before the National academy of sciences at Washington, April 19, 1887.

large groups, they give some broad indications of a highly suggestive character; and though affected with great inequalities, which for the time being seem to be anomalous, these anomalies are as instructive as the main facts themselves.

We have given the preliminary plotting of the intensities in the map before you. The first point to which we shall invite attention is the magnitude of the area affected by the shocks. It was sensibly felt in Boston, which is the most distant point on the Atlantic coast from which affirmative reports have been received. From Maine the answers are all negative. Most of those from New Hampshire are negative, but two or three positive ones show clearly that it was felt in sensitive spots. In Vermont, affirmative reports come from St. Johnsbury and Burlington on Lake Champlain. No positive reports come from the Province of Quebec. In New York state it was felt in the vicinity of Lake George, and at Lake Placid and Blue Mountain Lake in the Adirondacks. In Ontario it was quite noticeable in several localities, though the great majority of reports from that place are negative. In Michigan it was noted in several places; and at Manistee lighthouse, on Lake Michigan, the trembling was strongly marked. In Wisconsin, though many of the reports are negative, it was felt quite strongly at Milwaukee, and was also noticed at Green Bay and at La Crosse on the Mississippi, 967 miles from Charleston, — the remotest point within the United States which has given a positive report. In central Iowa and central Missouri it was unmistakably felt. In Arkansas the eastern portion of the state from sixty to seventy-five miles west of the Mississippi gives numerous positive reports. In Louisiana the reports are mostly negative, but numerous persons in New Orleans felt the shocks, and recognized their nature. In Florida it was universally felt, and in the northern part of the state was severe and alarming. From the Everglade region, of course, no reports have been received, as it is uninhabited: but in some of the Florida Keys it was felt in notable force. From Cuba a few reports have come; and the most distant point in that island which was shaken was Sagua la Grande, where the vibration was very decided. Lastly, a report comes from Bermuda, a thousand miles distant from Charleston, which leaves little doubt that the tremors were sensible there.

The area within which the motion was sufficient to attract the attention of the unexpectant observer would be somewhat more than circumscribed by a circle of a thousand miles radius; and the area of markedly sensible shaking, would, including the oceanic area, be somewhere between two and one-half and three million square miles. In this estimate, however, only well-defined seismic movement of notable force is considered. There are reasons for believing, that, by proper instrumental observation, the movement could have been detected over a much greater area. In the first place, it is to be noted that the peripheral portions of the observed area lie in districts which are rather thinly populated, sometimes also in districts which, from the nature of the ground, do not disclose forcibly the passing shock. Furthermore, the passing wave in the outer portions of the area was almost everywhere of an undulatory character and of great wave-length, and, while still retaining a large amount of energy, did not often dissipate itself into those smaller and shorter tremors which are very much more likely to attract attention, though really possessing very much less energy. Six hundred miles from the origin the long swaying motion was felt, and was often sufficient to produce seasickness, yet was unaccompanied by sound or by the tremulous motion due to short waves.

It will be observed upon the map that there are several large tracts which show a comparatively feeble intensity, while completely surrounding them is the general area of greater intensity. The most conspicuous of these areas of silence is the Appalachian region. The facts here are extremely interesting and suggestive. It has been generally supposed that a mountain-range serves as a barrier to the propagation of earthquakes, not from any known relation of cause and effect, but merely as the result of observation. In Japan it is universal testimony that the central range of the island marks the dividing-line between earthquake and no earthquake. The shocks, so frequent there, are seldom noticed beyond the mountains. A similar conclusion has been drawn from South American earthquakes, and also from those which have visited southern Italy. As soon as the data in the earlier stages of the inquiry began to indicate insulated areas of minimum action, they were completely investigated, and every effort has been made to secure full data from them. The result has been to show satisfactorily that such was the case. The Appalachian belt south of middle Pennsylvania disclosed a few spots where the shaking was considerable; but in the main it was but lightly affected until we reach the extreme southern portion of this range, where the shocks begin to be somewhat vigorous, even in the mountains. West and northwest of the range, however, the force of the undulations resumes even more than its normal vigor. In eastern Kentucky and south-eastern Ohio the force of the shocks was very considerable

causing general alarm. Chimneys and bricks were shaken down, and the oscillation of the houses was strongly felt. In south-eastern Ohio nearly every theatre, lodge, and prayer-meeting was broken up in confusion. It does not appear that the Appalachians offered any sensible barrier to the progress of the deeper waves, but it does appear that they affected in a conspicuous degree the manner in which the energy of the waves was dissipated at the surface. Another minimum area was found in southern Indiana and Illinois, and also in southern Alabama and Mississippi. There is a curious circumstance connected with the minimum area in Indiana and Illinois. On the 6th of last February an earthquake of notable force occurred in just this locality. Circulars were sent out at once, and, on plotting the isoseismals, they showed a singular coincidence in almost exactly filling the vacancy or defects of intensity of the Charleston earthquake. At present there is nothing to indicate whether this coincidence is accidental, or whether there is some hidden relation.

Where the waves passed into the newer delta region of the lower Mississippi, the surface intensity of the shocks rapidly declined. This is indicated in the map by the compression of the isoseismals in those localities. We incline to the opinion that this sudden diminution of the intensity is due to the dissipation of the energy of the waves in a very great thickness of feebly elastic, imperfectly consolidated, superficial deposits. It is a matter of common observation in all great earthquakes, that the passage of the principal shocks from rigid and firm rocks into gravels, sands, and clays, is, under certain circumstances, attended with a local increase in the amplitudes of the oscillations and in the apparent local intensity and destructiveness; and the reason for it is intelligible. But, where such looser materials are of very great thickness and great horizontal extent, the reverse should be expected: for, when a wave passes from a solid and highly elastic medium into a less solid and imperfectly elastic one, the amplitude may be suddenly increased at the instant of entering; but so rapid is the extinction, that, if the new medium be very extensive, the impulse is soon dissipated.

Many reports throughout the central states indicate localities of silence which are not expressed upon the map. The reason for omitting them is, that it has been impracticable to secure a sufficient density of observation (i.e., a sufficient number of reports per unit area) to enable us to mark out and define these smaller areas with very great precision. To do this for the whole country would require some tens of thousands of observations and the expenditure of tens of thousands of dollars to systematize and discuss the data. A map shaded to show the varying intensity by varying the depth of the shading would have a mottled appearance, in which the mottling would be most pronounced in the areas of a little below the mean intensity, say, between the isoseismals 3 and 5. This fact is of great importance in the interpretation of the isoseismals, for the omission to consider it results in giving to the middle isoseismals too high a value. In any isoseismal zone, what we should like to ascertain is the mean intensity of the whole area included within that zone. As a matter of fact, the data we possess consist more largely of maximum than of minimum or average intensities, and therefore tend to considerably augment the mean derived intensity above the true mean. This will become apparent by an inspection of the map where the zones of 5, 6, and 7 intensity are disproportionately broad, while those of 3 and 4 are disproportionately narrow. We have not attempted to allow for this source of error, though fully aware of it, because we had no means of determining what allowance to make. We have drawn the lines wholly upon the face of the returns, and the investigators who may attempt to utilize our results must grapple with the corrections as best they may.

Throughout the states of North Carolina, South Carolina, Georgia, and north-eastern Florida, and, in general, anywhere within about two hundred and fifty miles of the centre, the energy of the shocks was very great. At Columbia, Augusta, Raleigh, Atlanta, and Savannah the consternation of all people was universal. The negroes and many of the poor whites were for a week or two, not exactly 'demoralized,' but intensely moralized, giving themselves to religious exercises of a highly emotional character; the stronger and deeper natures among them being impressed with a feeling of awe, the weaker natures with a feeling of terror. And this was general throughout the large region just specified. In all of the large towns within two hundred miles of Charleston, more or less damage was suffered by houses and other structures. Walls were cracked to such an extent as to necessitate important repairs, dams were broken, chimneys were overthrown, plastering shaken from ceilings, lamps overturned, water thrown out of tanks, cars set in motion on side-tracks, animals filled with terror, fowls shaken from their roosts, loose objects thrown from mantels, chairs and beds moved horizontally upon the floor, pictures banged against the walls, trees visibly swayed and their leaves agitated and rustled as if by a wind. These occurrences were general, and were more strongly marked, until they became

terrifying and disastrous as the centre of the disturbance was approached. At Augusta, 110 miles distant from the epicentrum, the damage to buildings was considerable, and at the arsenal in that place the commanding officer's residence was so badly cracked and shattered as to necessitate practical reconstruction. In Columbia, 100 miles distant, the shock was very injurious to buildings, and appalling to the people, but no substantial structures were actually shaken down. In Atlanta, 250 miles distant, there was no worse injury than falling chimneys and some slight cracks in the walls; but the houses were instantly abandoned in great alarm and confusion by their occupants, and many preferred passing the night in the streets to re-entering their dwellings. At Asheville, N.C., 230 miles distant, and at Raleigh, 215 miles distant, the shocks were quite as vigorous as at Atlanta.

Coming nearer the seismic centre, we find the intensity increasing on all sides. The region immediately about the epicentrum in a great earthquake always discloses phenomena strikingly different from those at a distance from it; and the differences are not merely in degree, but also in kind. The phenomena characteristic of the epicentral area cease with something like abruptness as we radiate away from the epicentrum. The central phenomena are those produced by shocks in which the principal component of the motion of the earth is vertical. Proceeding outwards, these predominating vertical motions pass, by a very rapid transition, into movements of which the horizontal component is the greater, and in which the undulatory motion becomes pronounced. The epicentrum, and the zone immediately surrounding it, is the portion of the disturbed tract which merits the closest attention; for it is here that we may find the greatest amount of information concerning the origin and nature of the earthquake. To appreciate this, we will venture to offer some theoretical considerations.

Allusion has already been made to the indefinite character of the data used for estimating the intensity of the shock. There is no unit of intensity which is at present available. In selecting certain effects of an earthquake to characterize varying degrees of intensity, the most that can be hoped for is a means for discriminating whether the relative energy of a shock is greater or less in one locality than in another. But how much greater and how much less — in conformity with what law — is a problem which remains to be solved. An earthquake impulse, however, is a form of energy transmitted as an elastic wave through the deeply seated rocks, and its propagation and varying intensity are subject to the laws of wave-motion. There must be, therefore, some typical law governing the rate at which such a wave diminishes the intensity of its effects as it moves onward. To anticipate the objection that this typical law would apply only to a medium which is perfectly elastic, homogeneous, and isotropic, while the rocks are far from being so, we reply that we have investigated the objection, and are satisfied, that, while it has some validity, the effect of these inequalities is not great enough to seriously impair the applicability of the law, nor to vitiate greatly the results to be deduced from it. The analysis we offer is a novel one. We attach considerable importance to it, and the consequences which flow from it are somewhat remarkable.

Let us suppose an elastic wave to originate at a point $C$ (fig. 1), situated at the depth $q$ below the

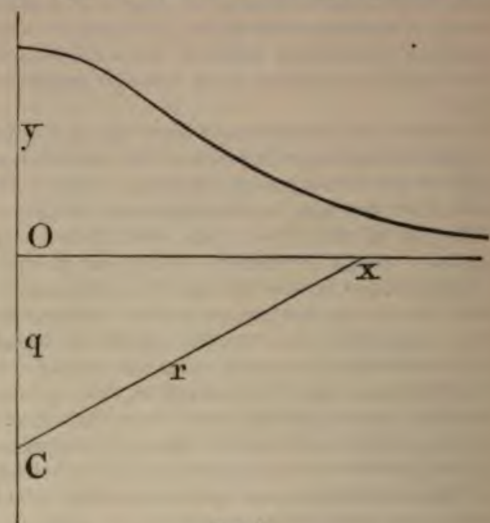



FIG. 1.

surface. Let the intensity of the shock (amount of energy per unit area of wave-front) at the distance unity from $C$ be denoted by $a$. Since the intensity is inversely proportional to the square of the distance, the intensity at the epicentrum would be $\frac{a}{q^2}$. Take any other point on the surface of the earth at the distance $x$ from the epicentre, and connect it with $C$ by the line $Cx$. The intensity at any such point will obviously be equal to $\frac{a}{r^2}$. If we denote the intensity by $y$, we shall then have the equation,

$$y = \frac{a}{r^2} = \frac{a}{q^2+x^2}$$

This equation expresses a curve which will serve as a graphic representation of the way in which

the surface intensity varies along a line radiating from the epicentre.

The first noteworthy feature of this curve is the contrast between the rapidity with which the intensity diminishes near the epicentre, and the slowness with which it diminishes at remote distances. Thus, at a distance from the epicentre equal to the depth of the focus, the intensity has fallen to one-half, at twice this distance it has fallen to one-fifth, and at three times the distance to one-tenth, of the intensity at the epicentre. This suggests at once the possibility of making an approximate estimate of the depth of the focus, based upon the rate at which the intensity of the shock at the surface diminishes in the neighborhood of the epicentre. If we were able to construct upon any arbitrary scale whatever a series of isoseismal curves around the central parts of the earthquake with any approach to accuracy, this depth would follow at once from the relations of these isoseismals to each other. In the case of a very powerful earthquake in a region which is so flat and uniform in its features as the vicinity of Charleston, this can be done with a rough approach to accuracy.

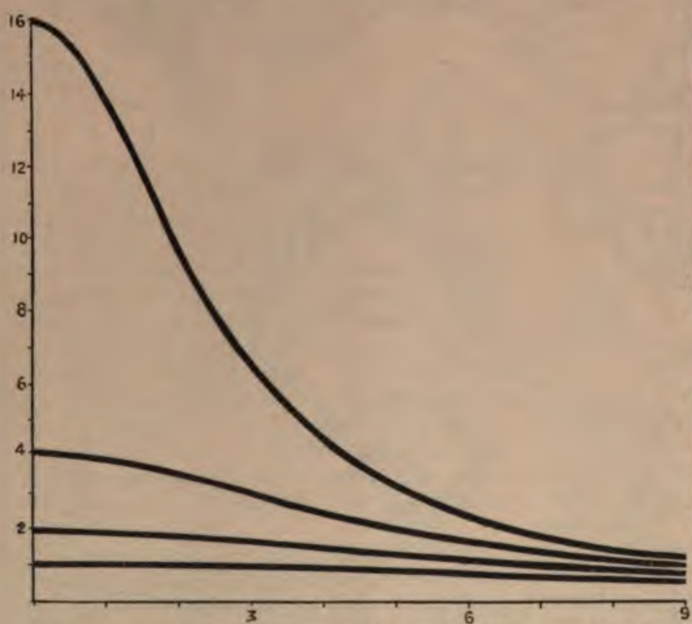


Fig. 2.—Energy constant, depth varying in ratios 1, 2, 3, and 4.


Fig. 3.—Depth constant, energy varying in ratios 1 to 6.


Fig. 4.—Depth and energy both variable, but with constant intensity at the epicentre.

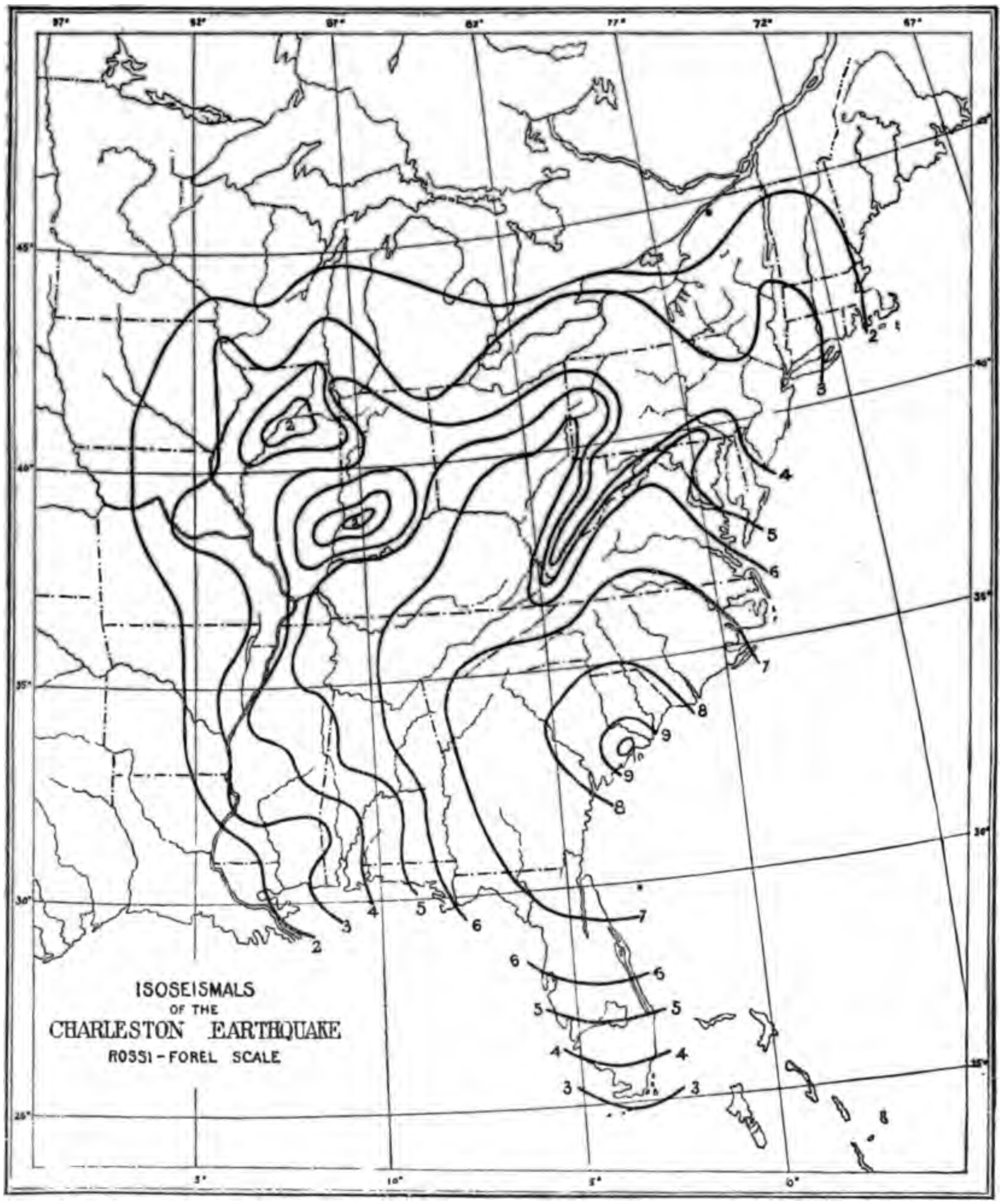
To appreciate more fully the validity of this mode of reasoning, let us take a series of these intensity curves, and vary the values of the constants. And first let us suppose the total energy of the shock, measured by the constant $a$, remains the same, while the depth of the focus varies. The first series of curves (fig. 2) will enable us to make a comparison of the effect of two or more shocks of the same total energy, but originating at different depths. The intensity at the epicentre being inversely proportional to the square of the depth, the shallower shock would be much more energetic than the deeper one; while at a great distance from the epicentre the two would be approximately equal in their effects. The rate of diminution of intensity would be correspondingly varied, and we might commit large errors in estimating these ratios on the ground, while the error of the depth deduced for the focus would be less than our errors of estimate. In short, the method is not sensitive to small or moderate errors of observation.

The second series of curves (fig. 3) is conditioned upon the assumption that the depth remains constant, while the energy of the shock varies. In these curves, the ordinates corresponding to any abscissa are proportional to each other in a simple ratio. In the first series they are proportional to each other in a duplicate ratio.

The third series (fig. 4) represents the effect of varying both the energy and the depth in such a way that the intensity at the epicentre is constant.

It will appear, therefore, that every shock must have some characteristic intensity curve, depend-

ing upon the total energy and the depth below the surface. The intensity at any point on the surface will therefore depend upon these two quantities, — energy and depth. It still remains to find some means of discriminating whether the intensity at any point is due to a more energetic shock deeply seated, or to a less energetic one nearer the surface. The criterion is soon given.




It is obvious that in any shock there is some point at some particular distance from the epicentre at which the rate of diminution of surface intensity has a maximum value. As we leave the

epicentre and proceed outwards in any direction, the intensity diminishes, at first more and more rapidly, but farther on diminishes less and less rapidly. We wish to find the point at which the rate of decline changes from an increasing to a decreasing rate. In the curve, this point is represented at the point of inflexion, where the curve ceases to be concave towards the earth, and begins to be convex towards it. To find the co-ordinates of this point, we differentiate the equation of the curve twice, and equate the value of the second differential coefficient to zero, and deduce the corresponding value of the abscissa $x$,

$$\frac{d^2y}{dx^2}=\frac{8ax^2-2a\ (q^2+x^2)}{(q^2+x^2)^3}=0,$$

which equation is satisfied when

$$8ax^2=2a\ (q^2+x^2),$$

whence

$$\pm x=\frac{q}{\sqrt{3}}.$$

In this value of $x$ it is seen that the constant $a$ has disappeared; and the abscissa of the point of inflexion is therefore independent of the energy of the shock, and dependent upon the depth alone. The meaning of this is, that the distance from the epicentre to the point where the rate of decline of the intensity is greatest is simply proportional to the depth of the focus, and is the same whether the energy be greater or less. This property of the intensity curves makes us independent of any absolute standard of measurement for the intensity, and all that we require is to find with reasonable approximation the points where the intensity falls off most rapidly. The depth of the focus follows at once.

The determination of the epicentral tract is chiefly the work of Mr. Earle Sloan of Charleston, a young civil engineer, who, immediately after the disaster, made an extensive series of observations. In the brief time at his disposal he accumulated a surprisingly large amount of detailed information, and in searching for it exercised a discrimination and sagacity which would have been highly creditable to the most experienced and learned observer. It is to be regretted that his business engagements prevented him from continuing the work. As it is, he has located with considerable precision the epicentral tract, and has furnished data which show well the variation of intensity along several lines radiating from it.

The summary obtained from the examination of Mr. Sloan's data is as follows: the tract which includes the most forcible action of the earthquake is an elliptical area about twenty-six miles in length, and with a maximum width of about eighteen miles. The major axis of this area is not a straight line, but a curve, which is concave towards Charleston, and is situated from fourteen to sixteen miles west and north-west of that city. Along this line there are three points, each of which has all the characters of an epicentrum, determined by as many distinct shocks, each having a focus of its own. Much the most powerful shock centres in the northernmost focus, though the other two were of sufficient energy to have occasioned great havoc if either of them had occurred alone. The southernmost was also considerably more energetic than the middle one. The distance between the northern and southern epicentrum was about twelve miles. Within this tract, except near the edges of it, the motion was most conspicuously of subsultory character; i.e., motion in which the vertical component predominated over the horizontal. The marginal portions of this area, where the character of the movement changes, and where the intensity falls off most rapidly, seem to be very well indicated. The positions where the intensity most rapidly declines may be located with an error not exceeding one or two miles on both sides of the epicentres. The South Carolina railroad crosses the tract in a straight line very near the most forcible seismic vertical. The first point where the intensity falls off with greatest rapidity is near the nine-mile post, measuring from the railway depot in Charleston; and so well marked upon the ground are the indications of this change, that it seems very improbable that this point is more than a mile distant either way from the precise point we seek to locate. Passing north-westward through Summerville to the opposite side of the tract, we find the corresponding point of most rapid decline in the vicinity of the twenty-third-mile post. This gives us a base-line with which to measure the depth of the focus of the principal shock. The computed depth is twelve miles, with a probable error of one or two miles. The computed depths of the other foci are about the same, but the probable errors are somewhat larger.

In speaking of a focal point of a shock, it must be understood as referring to the centre of all the forces, considered with reference both to amount and direction, which constitute a great seismic impulse. The presumption is, that this impulse originates in a large subterranean tract of which this ideal focus is merely the central point, or nearly so. The form of the subterranean tract may be any thing, and, within limits, may have its three dimensions (length, breadth, and thickness) of any magnitude, and bearing any ratios to each other. The form and dimensions of it, we

cannot, of course, determine, though it may be possible to obtain some notion of its most general features if the data are sufficient.

This method of computing the depth of a seismic focus is here proposed for the first time. The method employed by Mallet, which consists in finding the angle of emergence of a wave-front from the earth by studying the configuration of cracks in buildings, is believed to be pretty nearly valueless by all seismologists. There is no definite angle of emergence, of the nature he contemplates, disclosed at the surface. Certainly in Charleston there was nothing of the kind to be found. The method employed by Seebach is sound in theory, but it requires such extreme accuracy of time-determinations that very small errors of time give very large errors in the result. Our own method consists in finding two points on opposite sides of the seismic vertical, at which the changes in seismic action along a given line are most strongly marked. These points ought to be indicated in powerful earthquakes with a fair approach to precision, and the probable errors of determination should not usually exceed one or two tenths of the distance between the two points. The feebler the shock, however, the less is the degree of precision to be expected. Whatever may be the errors in the estimate of this distance, the resulting error in the computed depth is smaller than the error of observation in the ratio of the square root of three to two. How much the estimate may be vitiated by want of homogeneity in the superficial strata, we have no means of determining; but we do not believe that it would be so affected to any great extent in such a region as South Carolina. Being independent of any absolute measures either of the surface intensity or of the total energy of the shock, the greatest difficulty of all is at once eliminated. Our own opinion of this method is, that it is incapable alike of very great precision and of very great errors.

Probably the first thought occurring to any one examining this method will be that the determination of the two required points would be liable to very large errors. But, if he will examine the varying values of the ordinates of the curve corresponding to varying values of the abscissas and of the depth, we think he will be satisfied that the limits within which each of the two points of inflexion must fall cannot be wide apart, and that an error in the determination of the base-line greater than two-tenths of its estimated length would in such a country as Carolina be very improbable. It will appear that the relations of these variables are such as to restrict the locus within which the desired points are to be found to a very narrow annulus around the epicentrum. We believe the method will improve upon acquaintance.

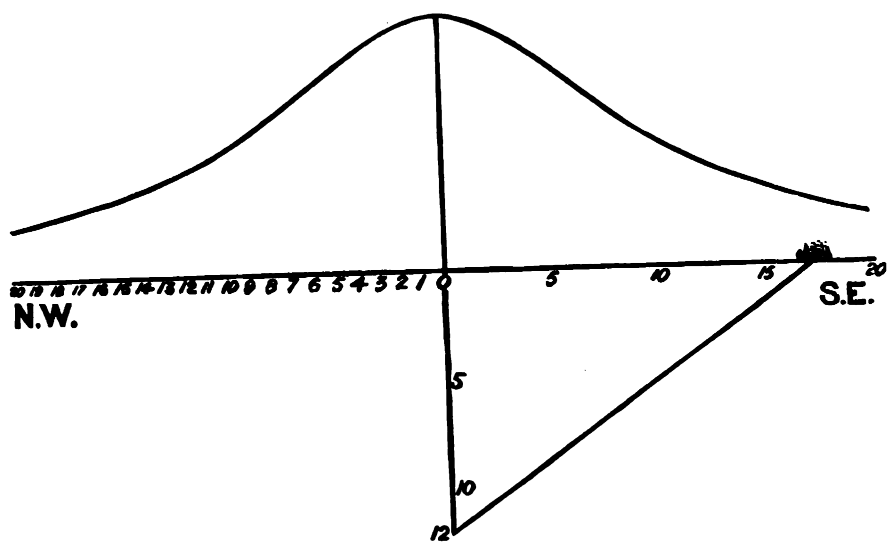



FIG. 5.—INTENSITY CURVE OF CHARLESTON EARTHQUAKE.

We have endeavored to apply our method of computing the depth of the focus to other earthquakes, but have found difficulty in obtaining any thing more than very general results, such as the following. The depth of the Charleston earthquake was relatively great; and we find reason

for believing, that among those great earthquakes of the last hundred and fifty years, of whose effects we possess any considerable knowledge, none have originated from a much greater depth, and few from a depth so great. Our reasoning is this: very few earthquakes have been felt at a distance from the origin so great as a thousand miles; but the greatest distance at which the tremors are felt is the best measure of the total energy of the shock. On the other hand, the intensity of the Charleston earthquake in the epicentral tract was relatively low in comparison with other great earthquakes. If, then, any shock is more intense at the epicentre without extending to a greater distance than that of the Charleston earthquake, it is certain that its focus was nearer the surface. This is true of the vast majority of recent earthquakes which have been sufficiently investigated. It is suggested that all estimates of the depth of earthquake foci much exceeding twelve miles are in need of re-examination.

The city of Charleston is situated from eight to ten miles outside of the area of maximum intensity, and did not experience its most destructive power. Following the law which we have laid down, the intensity of the shock at Charleston was only three-tenths what it must have been at the epicentrum, and about one-third the intensity at Summerville. The diagram (fig. 5) showing the long intensity curve stretching from Charleston to a point forty miles north-west of it, will illustrate the position of the city with reference to the varying force of the shock.

Had the seismic centre been ten miles nearer to Charleston, the calamity would have been incomparably greater than it was, and the loss of life would probably have been appalling. Another circumstance greatly broke the force of the shocks. All of the coastal region of the Carolinas consists of a series of clays and quicksands, which have been penetrated by artesian borings to a depth of two thousand feet, and which are believed to have a much greater thickness. These beds of loose material, no doubt, absorbed and extinguished a considerable portion of the energy of the shocks. We have already remarked that a wave passing from firmer and more elastic material into material less firm and elastic, produces at first an increased amplitude of wave-motion which is liable to be more destructive or injurious to buildings. But, if the mass of less consistent strata be very great, the reverse result is produced, by reason of the rapid extinction of the energy in passing through a considerable length or thickness of very imperfectly elastic material. We cannot but think that Charleston owes in some measure its escape from a still greater calamity to the quicksands beneath the city.

Another aspect of the same fact, if such it be, is found a hundred miles west and north-west of Charleston. Here the loosely aggregated sediments of tertiary and cretaceous age which cover the Carolina coastal plain have thinned out, and the crystalline rocks appear at the surface, thinly covered with soil and alluvium. All along the junction of these loose strata and superficial material with the metamorphics, the intensity of the shocks was conspicuously greater than to the eastward and southward. The loose covering of these firm rocks is just thick enough to give full effect to the increased amplitude of vibration which occurs when the wave passes from very solid and elastic rocks to those which are less so.

We have also endeavored to reach some trustworthy estimate of the amplitude of movement at the surface, but the results are meagre and far from satisfactory. The 'amplitude of the earth particle' in any earthquake is a question of great practical importance, and it is much to be regretted that no better facilities for determining it can be obtained. There were, however, many occurrences at Charleston bearing upon this question, which are extremely difficult to explain upon any valuation of the amplitude less than ten inches to a foot. Such amplitudes, however, were most probably limited to spots here and there, while in other spots it was probably much less. That within a small area the amplitude of movement in the surface soil varies between very wide limits, seems to be a practically certain conclusion from the observations. In Charleston it appears to have been greatest in the 'made ground,' where ravines and sloughs were filled up in the early years of the city's history. The structures on higher ground, though severely shaken, did not suffer so much injury.

With regard to the time data from which the speed of propagation must be computed, we are not yet in a position to give final results, but can only state how the problem stands at present. The time reports have been placed in the hands of Professors Rockwood and Newcomb, with the request that they would scrutinize and discuss them. But neither has been able to finish, as yet, the task he has so courteously undertaken. Probably the greatest difficulty in the way of determining the speed of propagation arises from the ill-defined character of the disturbance at considerable distances from the origin, and from the very considerable duration of it. Wherever a time observation seems to be well authenticated, there still remains, in most cases, the difficulty of deciding to what particular phase of the earthquake the

record refers; and this difficulty is a very serious one. At Summerville the first shock came almost like an explosion. Before people had time to think, they were pitched about like ten-pins. At Charleston there was a perceptible interval, estimated at from five to eight seconds, from the first note of warning to the maximum of the great shock. At Savannah (90 miles distant) the interval from the beginning to the first maximum was considerably longer, probably ten to twelve seconds; at Augusta (115 miles) the interval was still greater; and, generally speaking, the greater the distance, the more the phenomena were 'long drawn out.' The duration of the earthquake at Charleston will probably never be known with accuracy, but the general testimony ranges between fifty and ninety seconds. At Washington (450 miles) Professor Newcomb, with his watch in his hand, observed a duration of perceptible tremors with two maxima lasting about five and one-half minutes. Professor Carpmael's magnetographs recorded the disturbance, and he interprets their photographic traces as showing a duration of about four minutes. Mr. G. W. Holstein of Belvidere, N.J., gives five minutes very nearly as the observed duration. From other localities come well-attested observations showing durations of several minutes, though few of these pretend to give the whole time with any accuracy. This progressive lengthening of the shocks is a well-marked feature of the testimony. The explanation suggests itself at once. The elastic modulus of compression being greater than that of distortion, the speed of the normal waves is the greater, while the waves of distortion lag behind.

It is obvious that the phase which it is desired to observe should be the arrival of the first impulses, but the great duration of the tremors has left much doubt on this point. Stopped clocks were plentiful all over the country, but at what phase of the earthquake did they stop? So great, indeed, are the uncertainties on this point, that the observations of intelligent men, with watches in their hands, measuring a part of the shock and estimating the beginning, are in most cases to be preferred to stopped clocks, even if we knew with certainty that the clocks had been accurate to the second. It matters little how we twist and turn the time data: the smallest estimate we can put upon the speed of propagation must prove to be a great surprise to seismologists.

The time at Charleston of the occurrence of the main shock has been fixed at 9.51.10 P.M., 75th meridian, or eastern standard time (all times in this paper, unless otherwise specified, are reduced to that meridian). The uncertainty does not exceed ten seconds. The beginning of the first tremors at Charleston was from six to eight seconds earlier. The time at Summerville was probably less than four seconds earlier than Charleston. For all localities within two hundred miles, the time observations are of little value. So swiftly did the waves travel, that a small error in the time record gives a very large uncertainty in the resulting speed.

The nearest point which yields a valuable record is Wytheville, Va. (286 miles).[1] Mr. Howard Shriver was sitting at a transit instrument, waiting for the passage of a star, and at once noted the time at 9.52.37 (reduced to 75th meridian), giving a speed of about 3.3 miles (5,300 metres) per second. There is some slight uncertainty about the precise phase of the shock corresponding to the observation.

The signal service observer at Chattanooga (332 miles) gives only the nearest minute for the principal shock at 9.53, corresponding to a speed of 3.02 miles per second, or 4,860 metres.

The best observation in our possession is that of Prof. Simon Newcomb himself, at Washington (450 miles), who gives the time of the beginning of the shock at 9.53.20, with an uncertainty not greatly exceeding ten seconds. The resulting speed is 3.46 miles per second, or 5,570 metres.

From Baltimore (486 miles) Mr. Richard Randolph, C.E., reports a very intelligent and carefully verified observation of 9.53.20 as the beginning of the shock, — exactly Professor Newcomb's time for Washington, giving a speed of 3.74 miles, or 6,000 metres, per second.

At Atlantic City, N.J. (552 miles), a large pendulum-clock in the Fothergill House stopped at 9.54 very nearly. If this may be taken to be the beginning of the shock, the speed would be 3.26 miles per second, or 5,250 metres.

George Wolf Holstein, Belvidere, N.J. (622 miles), gives 9.54 for the beginning of the shock, and 9.59 for the end, and compared his watch next morning with the time of the Pennsylvania railroad. The gradual and uncertain character of the beginning and end would not admit of precise determination to seconds. The speed, taking 9.54 for the beginning, would be 3.66 miles, or 5,900 metres.

From New York City (645 miles) and its suburban towns and cities come many reports, all of which give either 9.54 or 9.55 as the nearest minutes. If we take as a mean 9.54.25 at New York and Brooklyn for the beginning of the shock, the speed would be 3.31 miles, or 5,330 metres.

[1] The distances are measured somewhat hastily with a scale upon the war department map of the United States, taking the greater epicentrum 16½ miles north-west of Charleston as the starting-point.

At distances greater than six hundred miles, the difficulty of associating the time records with particular phases of the shocks becomes very great. In most cases the motion was the swaying movement, with only faint tremors of the rapid kind ; and those who felt them were slow in recognizing their character. Readers must form their own opinions as to the degree of approximation to the time of the earliest movements, from the following records. We give them only as we received them, without attempting any discussion.

J. O. Jacot, watchmaker and jeweller at Stockbridge, Mass. (772 miles), was sitting by his regulator-clock, distinctly recognized the nature of the movement, and noted the time as 9.56. The phase of the shock is uncertain.

At Albany, N.Y. (772 miles), Mr. J. M. Clarke, of the New York state museum of natural history, heard the mortar falling down the chimney and the creaking and straining of the building. As soon as he appreciated the character of the disturbance, he noted the time by his watch at 9.56.30. He did not ascertain the error of his watch. In the same city, Dr. Willis G. Tucker says he instantly looked at his watch, and after comparing it next morning with the time of the Dudley observatory, and making correction of the error, gave 9.55 very nearly, with an error probably not exceeding twenty seconds.

From Fonda, N.Y. (780 miles), Francis L. Yates reports 9.55 (no particulars).

At Ithaca, N.Y. (695 miles), the regulator clock on the wall of the railway-depot stopped at 9.55 'exactly.'

At Gowanda, N.Y. (666 miles), where the shocks were faintly felt, W. R. Smallwood, watchmaker and jeweller, noted the end of the perceptible shocks at 9.55.30 by his regulator-clock.

At Toronto (753 miles) the earthquake was recorded automatically upon the magnetographic traces in the observatory of Prof. Charles Carpmael, superintendent of the Meteorological service of Canada. In his letter of Sept. 14 he says, "I may state that at 9.55 P.M. all our magnetic needles were set in motion by earth-tremors. The vibrations of the magnets continued for about four minutes. I would say, that, from later and more careful measurements from our magnetic curves, I make the time of the earth-tremor at Toronto to be 9.54.50 P.M. standard : this time, I should say, would not be astray more than a few seconds." As this record was automatic, and gave not only the time but the phases, it has been thoroughly investigated by Professors Newcomb and Carpmael, assisted by Mr. C. A. Schott of the U. S. coast survey. The final result of this reexamination is to change Professor Carpmael's computation to 9.56.18 for the beginning of the tremors, with a probable error of fully one minute. This large probable error is due to the very small scale upon which the magnetograph records time intervals (one-tenth of a millimetre corresponding to twenty seconds), and to want of sharpness in the photographed traces. This time gives 2.66 miles per second, or 4,250 metres, with a probable error of one or two tenths the amount.

The clock in the Western union telegraph office at Pittsburgh (523 miles) was stopped at 9.54.

From Cincinnati and suburban towns (500 miles) come many reports. In this city, local mean time is largely used, owing to the fact that it is nearly midway between the 75th and 90th meridians, where the only inconvenience of standard time is at a maximum. The correction to the 75th meridian is 37m. 40s. The Western union telegraph office gives 9.54. The *Times-star* newspaper gives from the clock in its own office 9.16 'exactly' (9.53.40 standard); at the *Commercial gazette* office, 9.17.45 local, 9.55.25 standard (probably noted after the shocks were over). At the fire-tower after the principal shock, 9.16 17 was noted ; clock error twenty-three seconds slow, giving 9.54.20 standard. Two other observers noting by watches give 9.16, and one notes an advanced stage of the shocks at 9 17, but they give no means of estimating their errors. At Covington, Ky., across the Ohio River, I. J. Evans, watchmaker and jeweller, reports his regulator-clock stopped at 9.17.20, Cincinnati local mean time ; phase of shock unknown.

From Crawfordsville, Ind. (622 miles), E. C. Simpson, C.E., reports through Prof. J. M. Coulter of Wabash college, "Suddenly felt my chair move, jumped up, and said, 'We are having an earthquake.' At once pulling out my watch, I found it was 8.54 P.M., standard time (central). Professor Coulter adds, that the watch was exactly with railroad time as shown at the railroad-station and also by the town-clock.

From Dyersburg, Tenn. (569 miles), Louis Hughes writes, "My time-piece was an English patent lever watch of Charles Taylor & Son, London, which from business necessity I keep closely with railroad time at the station, which receives the time at ten o'clock every morning. The railroad uses central time. My first thought was that the shaking was caused by the children in the next room, but in the next moment, recognizing the peculiar sensation, I dropped the newspaper and observed the time, which was probably from four to six seconds after 8.54, and from that approximated it in even minutes." Speed 3.25 miles, or 5,230 metres.

At Memphis, Tenn. (590 miles), the signal-service observer reports a considerable number of stopped clocks, one at 9.54, and the others at 9.55. For some unaccountable reason the seconds were not noted. The phase is unknown.

The foregoing comprise those time reports which seem to justify the presumption that the errors do not exceed one minute. There are others which are obviously rude approximations, giving exact hours, quarter-hours, or tens of minutes. There are also some which look at first like good observations, but which surely involve some large unexplained error.

As the discussion of the time data is now progressing, no further comment will be offered here, beyond the remark that there can be no doubt that the speed of propagation exceeded 3 miles, or 5,000 metres, per second. The only questions are, how much this speed was exceeded, and whether the speed along any given line was constant. As regards the latter question, the data are not yet precise enough to justify an opinion. This matter will be inquired into.

The high rate of propagation will probably prove unexpected to European seismologists. We propose, however, to follow it up with the suggestion that it is about the normal speed with which such waves ought to be expected to travel, and that all determinations of the rate of propagation in any former great earthquakes, which are much less than 5,000 metres per second, for normal waves at least, are probably erroneous in proportion as they fall short of the Charleston earthquake. Finding, as the time reports accumulated, that a speed in excess of 5,000 metres was indicated, and this presumption having become a conviction, we were led to inquire whether there were not some speed deducible from the theory of wave-motion in an elastic solid to which all great earthquakes ought to approximate.

In a homogeneous and perfectly elastic solid, the rate of propagation is, according to theory, dependent upon two properties of the medium, — elasticity and density. There are two coefficients of elasticity in solid bodies, one of which measures their resistance to changes of volume, the other to changes of form. Absolute experimental determinations of the values of these coefficients have never been made. If, however, we knew the ratios of these coefficients in one substance to the homologous coefficients in any other substance, and if we also knew the rate of propagation in either of them, the rate in the other would be at once deducible. The rate in steel bars has been the subject of much experimentation, and is given by Wertheim, whose researches have been as careful as any, at 16,800 feet per second. But, as the waves in a steel bar are essentially waves of distortion, he multiplies this result by $\sqrt{\frac{3}{2}}$ or $\frac{5}{4}$ for the normal wave, giving a speed of 21,000 feet per second. The elastic modulus of steel for engineering purposes is usually taken to be 29,000,000. The corresponding modulus for such rocks as granite and basalt in a very compact state is about 8,000,000. If we may assume that these moduli are proportional to the two elasticities of the two substances respectively, we can compute the rate of propagation in rock. This assumption may or may not be true; but we assume it to be so. Let $V_s$ be the rate of propagation in steel, and $V_r$ the rate of propagation in rock, and let $e_s$ and $e_r$ be their true elasticities of volume, and let $D_s$ and $D_r$ be their respective densities. Our assumption is, that $29 : 8 : : e_s : e_r$, from which we may form the equation,

$$\frac{V_s}{V_r} = \sqrt{\frac{e_s}{D_s} \times \frac{D_r}{e_r}}$$

Taking the density of steel at 7.84, and of deeply buried rocks in their most compact state at 2.85,

$$\frac{V_s}{V_r} = \sqrt{\frac{29}{7.84} \times \frac{2.85}{8}} = 1.15 \text{ nearly.}$$

Taking the rate of compressional waves in steel to be 6,400 metres per second, gives 5,570 metres for similar waves in very compact and dense rock. The corresponding rate for waves of distortion would be 4,450 metres. These results are so near to those deduced for the Charleston earthquake that they seem to be worthy of consideration.

The experimental measurements of the rate of impulses obtained by Milne and Fouqué seem to us inapplicable. The elasticity of the surface soil, we think, is no more to be compared with that of the profound rocks which transmit the great waves of an earthquake, than the elasticity of a heap of iron filings is to be compared with that of an indefinitely extended mass of solid steel. The difference is *toto coelo*. But the rate of propagation is a question of elasticity and density chiefly. The effect of temperature we have not considered. Perhaps the most striking experiment ever made with an artificial earthquake was at the Flood Rock explosion in Hell Gate, near New York, where General Abbott found a speed of propagation approaching very closely to that of the Charleston earthquake.

The question which is undoubtedly of deepest interest in this connection is whether the Charleston earthquake throws any new light upon the origin of such events. While we are not prepared to say that absolutely nothing will be added to our information on this question, we are forced

to admit that we expect very little new light. Hitherto our efforts have been devoted to bringing together the facts, and to arranging and comparing them, and we have as yet given but little consideration to this final question. It will, however, shortly engage our attention; and, in anticipation of this, we prefer to remain silent for the present, fearing that if we commit ourselves here to any preference for a particular view, we may find ourselves encumbered with a bias arising from the intensely human propensity to defend, through thick and thin, utterances which have once been formally given.

C. E. Dutton.
Everett Hayden.

## WAGNER'S ANNUAL REPORT ON THE PROGRESS OF GEOGRAPHY.

It is always with some impatience that we expect the publication of Wagner's report on the progress of geography (*Geographisches Jahrbuch*), because we know that we shall find there a full report of the work done in the field and in the study, and that we shall have a never-failing book of reference. We do not know of any similar publication, — except the fragmentary notes published by the Smithsonian institution and in the journals of many societies, — and therefore it is indispensable to the geographer. Though *Petermann's Mittheilungen*, the leading German geographical journal, contains regular reports on recent publications, their character is different from those in the *Jahrbuch*, the reports in the journal giving a more detailed review of the single publications, and being more disconnected. The list of reviewed books is consequently not so full as that of the annual report. The latter gives a comprehensive account of the work done during the last two years. The present volume is the eleventh of the series. The editor, Prof. H. Wagner of Göttingen, has preferred to divide the material, and to publish alternating volumes, one containing the various branches of geography, the other the progress of explorations, methods and teaching of geography, etc. Through this division, the book has increased in volume and the report has become more exhaustive. The present volume contains the special part, geophysics, geognosy, oceanography, climatology, geography of plants and animals, and ethnology. The place of the late Professor Zöppritz is taken by Dr. Hergesell and Dr. Rudolph; the former report on deep-sea explorations has been enlarged so as to cover all problems of oceanography, and is given by Professor Krümmel; F. Toula reports on geognosy; the other parts are in the hands of the same specialists who gave the valuable reports of former years.

In looking at the long series of reports, we find that each number served more satisfactorily the purpose of being a reliable book of reference to all interested in geography. At the present time there are few branches of geographical study which are not embraced in the book. The steady development of the plan, by dropping unnecessary parts, including in one part what belongs together, and adding new departments which had developed into important branches of science, encourages us to hope that within a few years the whole domain of geography will be represented in it. We should wish, for instance, to have an additional report on the history of geography. That on terrestrial magnetism is promised for next year. Among the important additions in the volume of 1887 is the first report of the geography of ancient Greece and the neighboring countries. The ancient geography of other countries, except that of the birthplace of our culture, is so little studied, that the contents of a biennial report would be very meagre. We hope, with the development of these studies, which are principally carried on by ethnographers, we shall find an account of these also. In 1882 Egli's reports on the study of geographical names, and S. Günther's on the theory of map-projections, were added to the book. We consider it a waste of time and work, that the Physical society of Berlin continues its reports on physical geography in the way they were given before the *Jahrbuch* had attained its present importance. It is true that they contain some material not included in the *Jahrbuch*, for instance, measurements of heights, etc.; however, these would far better find their place in the latter publication than in the reports on the progress of physics.

The rapid development of the *Jahrbuch* and the fact that every department is intrusted to the care of a specialist, make it an extremely reliable and useful book, which is a valuable help to the student of geography.

*Geographisches Jahrbuch.* Vol. xi. 1887. Ed. by Hermann Wagner. Gotha, Justus Perthes, 1887.

## THE MECHANICS OF MACHINERY.

Professor Kennedy is well known as one of the ablest among British workers in this field, and this volume contains a series of lectures delivered by him to his classes during the period of his connection with the University college, on a subject with which he is especially familiar. As was to be expected, the work is one of exceptional value.

*The mechanics of machinery.* By Alex. B. W. Kennedy. London, Macmillan. 16°.

The subject is the mechanics of constrained motion, and is purely kinematics.

The book is a volume of about 650 pages, and is divided into a dozen chapters. The first six chapters consider purely geometric problems in the elements of kinematics and mechanism, introducing some interesting methods of solution involving 'virtual' rotations; securing a means of treating all mechanisms, whether of rotational or of rectilinear movement, by the same system; and greatly simplifying the work. In the seventh chapter, accelerations and retardations are considered; and in the succeeding chapter, static equilibrium and work-diagrams. Then follow chapters on problems in machine dynamics, and on parallel and other familiar mechanisms, and various trains. The last chapter considers the modifications introduced by the action of friction. In these applications we find the motions of the steam-engine and its accessories, of the fly-wheel, connecting-rod, and governor, and the various sorts of gearing. The author is one of the few writers who have yet had the courage to drop the fallacious and misleading so-called laws of friction, as enunciated by earlier writers, and to introduce the results, even though very briefly, of recent research, with correct statements of the enormously differing, lately discovered laws of friction of lubricated surfaces.

Professor Kennedy follows Reuleaux, in the earlier part of his lectures, as far as opportunity and necessity dictate, but soon gets out into a field all his own, and develops his treatment in his own logical and fruitful manner.

The book is well illustrated, pictorially and by examples; the references are conscientiously introduced throughout; and the volume, as a whole, is remarkably well adapted for use as a text-book in technical schools, and will also be found very useful to the practitioner. R. H. THURSTON.

## A MODEL FOR AMATEUR ASTRONOMERS.

BARON VON ENGELHARDT has recently published, in a handsomely printed and bound volume of two hundred and twenty quarto pages, a series of astronomical observations made at his private observatory in Dresden from 1879 to 1886. The observations were all made by Baron von Engelhardt himself, and they give evidence of a good observer, while the reductions have been made in a most thorough manner. It is rarely, indeed, that we find work of this character systematically carried on for so many years by an amateur; and it implies, moreover, a good deal of careful preliminary training. The field chosen is not the 'new astronomy,' with its many fascinations, but the more prosaic 'old astronomy,' the astronomy of the elder Struve and of Bessel, — painstaking measurements of double stars, comets, asteroids, nebulae, and clusters, observations of moon-culminations, occultations, etc., all valuable contributions to our knowledge of the positions and motions of the heavenly bodies. Here is an excellent example for the amateur astronomers of this country. There are plenty of fine instruments in the hands of amateurs, and only a moderate amount of industry is called for, yet hardly one of these instruments is doing any thing for the advancement of science. In England there are several private observatories of world-wide reputation, in which the owner either carries on regular observations himself, or employs a competent assistant; while here, since the death of Dr. Henry Draper, the field is almost deserted.

Baron von Engelhardt built a small observatory in 1877, in which was mounted an 8-inch Grubb equatorial; but, finding this at an inconvenient distance from his home, he put up a more elaborate building connected directly with his villa on the outskirts of Dresden.

The new observatory is a three-story tower, the upper story being surmounted by a cylindrical 'dome' containing a 12-inch Grubb equatorial. The second floor connects with the transit-room, in which is a 'broken-back' transit by Bamberg of 2.7 inches aperture. The observatory is also thoroughly equipped with subsidiary apparatus, clocks, chronometers, chronograph, etc. Upon the roof of the villa is a little 'comet observatory,' where were formerly two telescopes, one of 6.4 inches aperture, and the other of 3.7 inches. The larger instrument, which is patterned after the Strassburg comet-seeker, is of somewhat novel construction: the telescope is fastened by two long arms to the back of a comfortable chair, so that the eye-end of the telescope is just at the height of the observer's eye; the arms are pivoted to the chair-back, permitting a motion in altitude, while the chair turns about a vertical axis, like an ordinary office-chair, so that the astronomer can examine the whole sky rapidly and without fatigue. The mounting for this instrument is now at the University of Kiel.

The volume before us contains a full description of the instruments, illustrated by several plates. The observations and reductions are given in some detail, and the whole work would reflect credit upon any observatory.

*Observations astronomiques.* Par B. D'ENGELHARDT. Première partie. Dresde, 1886. 4°.

WORK will begin in June next on the Holstein canal, to connect the Baltic with the North Sea.

# SCIENCE.

FRIDAY, MAY 27, 1887.

## COMMENT AND CRITICISM.

DR. ALBERT SHAW of the Minneapolis *Tribune*, always a writer worth reading on economic subjects, prints in the current issue of the *Contemporary review* a very practical article, entitled 'The American state and the American man.' The article was suggested by an incidental remark made by Mr. George J. Goschen, now chancellor of the British exchequer, to the effect that *laissez-faire* is the practical rule in the United States, and state interference the rare exception. Dr. Shaw discusses and combats this assumption. He says, first, that Mr. Goschen's opinion is not only generally entertained in England, but will be allowed to pass unchallenged by the vast majority of intelligent Americans. To begin with, *laissez-faire* is in harmony with our independent, self-reliant character as a people. It is the doctrine imbibed by the young men of the country in school and college. But while professing to hold *laissez-faire* doctrines, the American does not fashion his practice in accordance with them. "He studies his political economy in a text-book of abstractions, and not in the history of nations or the concrete conditions about him. Consequently he manages to keep his economics and his practical politics as separate as some men do their religion and their business, and he is just as naïvely unconscious of it." Two further observations are preliminary to Dr. Shaw's main discussion. We cannot properly estimate the extent of state interference in a western state by checking off correspondences on a catalogue of the various functions that have been assumed by the British government. Circumstances must be considered in estimating the extent to which the state invades the domain of the individual. And, secondly, it is not the functions of the general government, which touches the average citizen in so few points, that should be taken as the basis of computation, but rather those of the state and local governments.

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Dr. Shaw then examines the legislation of the Minnesota state legislature during the sixty-day session of 1885. The number of laws that may be classed as instances of state interference is not only astonishingly large, but the laws themselves deal with the greatest variety of subjects. Prominent among them are the 'granger' laws concerning railroad and elevator supervision and control. Then come state loans of seed-grain to farmers whose crops had been ruined by grasshoppers. Agricultural fairs were subsidized and one hundred thousand dollars appropriated for a state fair-ground. Liberal exemption laws enable the farmer to avoid the payment of a portion of his debts. Dairy laws protect the butter-makers against artificial products, such as butterine. New laws regulate almost every detail of the cattle industry. Even brands are registered and protected by the state. Logging codes of minute detail regulate the lumbering trade. Insurance companies, savings banks, pharmacy, medicine, dentistry, and the oil trade are supervised and controlled. The fish and game laws are minute and exhaustive. One enactment specifies the maximum toll to be exacted by a custom mill for grinding wheat; another states when a dog may be slain with impunity; another prescribes in detail the character of the waiting-rooms which all railway companies must maintain at their stopping-places. The part played by the state in the matter of education is too well known to need mention. A bill was introduced, and found considerable support, which actually went so far as to forbid persons of opposite sex to skate together in a skating-rink, or even to be on the floor at the same time.

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Dr. Shaw emphasizes the fact that bills of this character are passed by men who profess adherence to *laissez-faire* principles. But no connection exists between their political philosophy and their votes. The proper cure for this anomaly the writer finds in unlimited state interference. "Let it be understood that it is within the legitimate province of the state to do any thing and every thing." The result would be more scientific law-making. Each new proposition would be carefully scrutinized, and would have to stand or fall on its own merits. Whether Dr. Shaw's proposed remedy is the best and speediest may be

fairly questioned, but the careful observer of current politics must have noticed the increasing tendency to turn to the legislature for any thing and every thing. It is time to call a halt, and it is the duty of our students of political science to determine for us how this may best be done. The question is worthy of their most careful study.

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THE FAITH-CURE and the mind-cure are at the present time attracting a great deal of popular attention; and almost daily, cures are announced, under this treatment, of persons who have, under all other methods, remained chronic invalids. It is not to be wondered at, that physicians denounce this treatment as charlatanism, but it was hardly to be expected that one of the most potent arguments against the validity of its claims should come from one of the clergy. In a recent sermon on this subject, Rev. E. C. Ray of Hyde Park, Ill., says, "Apparent cures are often followed by a relapse, temporary improvement by permanent decline. From reported cases of cure we must deduct many of unreported relapse: it is not in human nature, when a wonderful cure has been published abroad, to follow it up with an account of the relapse coming afterward. Mistaken diagnosis accounts for many supposed cures. Physicians often, patients more often, mistake the nature of a disease. Temporary swellings are called malignant tumors or cancers (thus cancer-doctors get their reputations); hysteria simulates almost every other disease, so as to deceive even the most elect of doctors; dyspepsia produces symptoms of heart-disease or other deadly illness. There can be no question that a large proportion of faith-cures and mind-cures, and a considerable proportion of cases under ordinary medical treatment, are cases of mistaken diagnosis, the disease being less serious in its nature than was supposed. Mistaken prognosis accounts for many cases; mistake as to what would be the outcome of the disease if no curative methods were employed. It is a truth seldom recognized by patients, though well known to physicians, that in most cases not hopelessly fatal from the start, there is from the start a strong tendency toward recovery. Dr. Austin Flint, Sr., than whom perhaps no abler physician has lived in this land, always urged upon his students the truth that not drugs, but *vis medicatrix naturae*, the healing-power of nature, is the means of recovery. The wise physician and nurse seldom attempt more than gently and humbly to assist Nature in her curative processes. Let me add the statement of a conviction derived from some years of such close scrutiny of medical practice of various schools as a pastor has good opportunity for, — a conviction agreed to, I think, by most physicians. The benefit of medicine is often not its direct action upon the disease or upon the body, but its action upon the mind, and through that upon the nervous system and the whole body, stimulating faith, hope, expectation of recovery, good cheer, which are probably nature's mightiest remedial assistants."

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THE FIRST EDITION of Dr. Orton's preliminary report on natural gas and oil in Ohio was exhausted in a few months, and the publication of the final or complete report on the oil and gas of Ohio having been still further, though, considering the rapid developments still in progress, perhaps not unwisely, delayed by legislative action, Professor Orton has just issued a second edition, with a supplement, showing the marvellous results accomplished during the last year (1886). The extreme activity in drilling deep wells in all portions of the state, and especially in western Ohio, will make this year always memorable in the history of Ohio geology. The explorations of no single year hereafter can make additions of equal value to our knowledge of the stratigraphy of the state. The leading facts have now been established; and we know the order from one thousand to two thousand feet below the surface in every portion of the state as well as we do the arrangement of the strata on the surface. The vital relation of the production of oil and gas to the geological structure is well exemplified in the facts now thoroughly established, — that throughout western Ohio and eastern Indiana every important gas-well has pierced the Trenton limestone at a depth not exceeding four hundred feet below sea-level, and that every successful oil-well has reached the same horizon at a point less than five hundred feet below tide: in other words, the contours of the Trenton limestone are the all-important element to be considered in locating new wells, and they can only be determined by drilling. It has been demonstrated that the Trenton limestone, which has been heretofore supposed not to come to the surface in Ohio, is actually exposed in the bed of the Ohio River above Cincinnati. In northern Ohio the Utica and Hudson River shales have the normal character and thickness of those

formations in New York; but toward the south they become gradually more calcareous, and the Utica also becomes thinner, and fails to reach the Ohio River; the Hudson River series overlapping it, and reposing directly upon the Trenton. The lower Helderberg series, which has been heretofore assigned a total thickness of one hundred feet, is proved to measure five hundred, possibly six hundred feet, and to include all the beds in Ohio formerly referred to the Salina and Oriskany groups. The Cincinnati uplift, formerly supposed to have a north-easterly trend, is shown to run almost due north in northern Ohio, and to send off an important branch through north-eastern Indiana; and it is along this branch that the important discoveries of oil and gas in Indiana have been made. The best gas-wells of north-western Ohio are now yielding from five million to fifteen million cubic feet each daily, and the oil-production for the entire field exceeds fourteen thousand barrels daily at the present time. The extent and rapidity of the development of the new districts are well shown in the statement that the Lima field alone now contains four hundred and twenty-four producing oil-wells, an average of more than one new well per day since the first discovery.

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THE SUGGESTION of Captain Bartlett, chief of the U. S. hydrographic office, that an international convention be called for the purpose of assigning different portions of the ocean to each maritime nation, will probably be favorably considered by congress. It is believed that this would prevent casualties at sea by ships running into floating derelicts. Captain Bartlett says in his report, "Each nation would patrol its own portion of the ocean for the purpose of towing in or destroying all obstacles. Frequent reports are received of ships running into these derelicts, and the number lost from this cause may be considerable. If shipmasters felt that every attempt was being made by civilized governments to clear the ocean of these dangers, their anxieties, which are sufficiently great from purely natural causes, would be materially relieved."

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## *THE POSITION OF EMIN PASHA.*

IT was in July, 1881, that Mohammed Achmed of Dongola, a carpenter, who had lived for some time as a hermit on the Island of Aba in the White Nile, declared he was the 'Mahdi,' the prophet whose arrival is expected by the Mohammedans about this time. The number of his adherents increased rapidly, and belief in him was strengthened by the failure of several Egyptian expeditions to capture him. In an encounter with the Egyptian troops he braved their guns, and so the belief in his invulnerableness was established. The Egyptian government failed to understand the seriousness of this movement, though it was frequently warned by Emin Bey, the governor of the equatorial province. The Arabs and Dongolans, who had been masters of these countries before they were conquered by the Egyptians, joined the fanatic adherents of the Mahdi, and soon the movement had spread over the whole country. The government, which had only by the greatest efforts succeeded in subduing the revolt of Soliman Pasha in 1878–80, was powerless against the Mahdi. He retreated before an expedition sent from Khartum, to the southern parts of Kordofan, and in December, 1881, vanquished the mudir of Fashode. At this time the serious disturbances caused by Arabi-Pasha threatened to overthrow the Egyptian government, and delayed further action against the Mahdi. Thus the number of his adherents increased rapidly, and within a short time he commanded a large army. It is not necessary to dwell upon such events as the destruction of the Egyptian army, Gordon's defence of the Sudan, the final fall of Khartum, and Gordon's death.

In 1878 Emin Pasha was appointed governor of the equatorial province by General Gordon. When he entered upon his duties, the country was in a general state of war. Only the banks of the Nile beyond Lado, the district of the Mvutan Nsige, and the country inhabited by the Shuli, were quiet. Nubian slavers invaded the country and captured slaves without meeting resistance. Emin succeeded in driving them out of the country and gathering the scattered natives into their villages. Under his peaceful government many roads were built, and the cattle, the most valuable possessions of the district, increased in number. He introduced new manufactures and the culture of new plants, and thus improved the province, which in 1882 yielded an income of $40,000, derived from taxes, while formerly it had an annual deficit of from $100,000 to $200,000.

At a time when the Egyptian government did not understand the seriousness of the disturbances caused by the Mahdi, Emin called attention to the imminent danger, but his warnings were disregarded. In April, 1882, during his visit to Khartum, he offered to treat personally with the Mahdi, and to use his personal influence and his acquaintance with the persons to bring about a *modus vivendi* between the parties. His offers

were rejected, however, and he received instructions to return to his province and develop its resources. He did so, but since that time the Mahdi has cut off his connection with Egypt, and the accession of King Mwanga in Uganda has cut off that with the south. A. M. Mackay the missionary, who is kept as a kind of hostage by the king, writes on June 26, 1886, in reference to this despot, "Again and again he has expressed his determination not to let us leave, being guilty in his conscience, and constantly alarmed by rumors from the east, partly arising from Dr. Fischer's journey that way, and partly from reports of the presence of what we think must be the main body of Bishop Hannington's caravan. . . . He has ordered our boats to be watched lest we should escape, and he is reported to have said that when he hears of an army reaching the Ripon Falls he will murder us at once, and then let the white men come and catch him. . . . Every time a fit of malice comes on, it is on suspicion that we mean to 'eat the country.' . . . Being alarmed, he is dangerous, while his insufferable conceit makes him obstinate" (*Scottish geogr. mag.*, Dec. 1886). It will be remembered that Junker found great difficulty in getting leave to return south.

The state of Emin's province in the summer of 1886 may best be seen from a letter written by him to Robert Felkin on July 7, 1886, which has been published in the *Scottish geographical magazine*. He says, "I am glad to be able to tell you that the province is in complete safety and order. It is true that the Bari gave us some little trouble, but I was soon able to restore order in their district. Since I last wrote you, all the stations are busily employed in agricultural work, and, at each one, considerable cotton plantations are doing well. This is all the more important for us, as it enables us, to a certain extent, to cover our nakedness. I have also introduced the shoemaker's art, and you would be surprised to see the progress we have made. We now make our own soap, and we have at last enough meat and grain, so that we have sufficient to keep life going ; such luxuries, however, as sugar, etc., of course we have not seen for many a long day. I forgot to say that we are growing the most splendid tobacco. . . . Our relations with Kabraga have still continued friendly. He has also had the goodness to send my letters to Mr. Mackay in Uganda, and has permitted me to buy several necessary articles from the Zanzibar Arabs who live in his country. Captain Casati has, on this account, acceded to my wishes, and taken up his residence with Kabraga in the mean time, in order to look after our interests. Dr. Junker is at present in Uganda, and hopes soon to start on his homeward journey. I am only too glad that he at least has been enabled to escape from here."

It will be remembered that the Mahdi, after the conquest of the province of Bar-el-Gasal, tried to attack Emin Pasha. His expedition, however, proved a failure. In the equatorial province communication was not interrupted at any time, and we hear of frequent journeys between Lado and the upper end of Lake Mvutan.

Since that time Emin's position has not become worse, as Junker succeeded in sending him from Uganda two thousand dollars' worth of cotton goods, and later news refer to goods bought by Emin's agents in Uganda. The latest letter of Emin Pasha is dated Dec. 18, 1886. He writes to Dr. Junker that King Mwanga allowed him to buy goods from Zanzibari merchants, and that he obtained permission to have ammunition and provisions sent from Zanzibar.

From these facts we conclude that Emin's position in his province is difficult on account of his isolation from Europe, but that there is no imminent danger. Therefore Stanley's expedition is not so much a relief expedition as one intended to provide him with such troops, guns, and ammunition as will enable him to hold his own in his province, and to continue the work he has so successfully begun. Evidently he is unwilling to leave his soldiers and officers, and to abandon a province in which, under the most adverse circumstances, he has restored peace, and saved the natives from the oppressions of corrupt officers and slave-hunters.

Stanley's expedition could not take the nearest and best-known route through Uganda, on account of the hostility of Mwanga. Neither was it advisable to avoid Uganda by passing north-east of the Victoria Nyanza ; for the Waganda frequently make war upon the tribes of that district, while they do not visit the region west of Unyoro. Though Stanley experiences considerable difficulty in reaching Stanley Pool, his expedition has been so far very lucky, and there has been hardly any unexpected delay. Once on the upper Kongo, he will not find any difficulty in reaching the rapids of the Mburu, from which point his route will be easterly through an unknown country. It is not probable that his large caravan will meet any serious obstacle, and we may hope that he will succeed in accomplishing his object, thus enabling Emin Pasha either to return, or to continue his work in safety.

That our readers may be able to follow the doings in Central Africa, we publish with this number a map of the region, which is corrected to date.

## INTERNATIONAL STATISTICAL INSTITUTE.

THE International statistical institute held its first meeting at Rome from April 12 to April 17. Among the distinguished scientists present were Sir Rawson W. Rawson of England, president of the institute; Signor Bodio, director-general of statistics in Italy; Professor Neumann Spallart of Vienna; Professor Levasseur of Paris; Professor Wagner of Berlin; Dr. Engel, formerly director of the Prussian statistical bureau; Dr. Broch of Norway; and M. Léon Say of Paris. It was resolved that the working members of the institute should be limited to a hundred and fifty, and they are to be chosen exclusively from those who make a special study of statistics, and take a real interest in them.

One of the most important papers presented was that of Dr. Engel, on "Consumption as the measure of the prosperity of individuals, families, and nations." The paper is described as elaborate and ingenious, and gave a valuation of the minimum cost of maintenance from birth to the age of twenty-five. Dr. Engel calculates that an infant cannot be nourished from birth to the end of the first year at a less cost than five pounds, and that by the age of twenty-five each individual has cost, in the way of maintenance, not less than nearly three hundred pounds.

He also gave a statement of the estimated share of the earnings of a family, contributed by each member of it. The estimate is based on the cost of maintenance of a family consisting of a father and mother, and six children under eleven years of age. Taking the total as 16.1, Dr. Engel's figures, representing the consumption of the different members, are these:—

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| The father | 3.5 |
| The mother | 3.0 |
| One child eleven years old | 2.1 |
| One nine years old | 1.9 |
| One seven years old | 1.7 |
| One five years old | 1.5 |
| One three years old | 1.3 |
| One a year old | 1.1 |
| Total | 16.1 |

Dr. Kekti of Hungary had a paper which confirmed Dr. Engel's conclusions, though it was written from a different point of view. Professor Ferraris of Italy read a paper on the movement of the precious metals between Italy and other countries, — a subject of peculiar interest to his countrymen, in view of their recent successful return to specie payments. Mr. Robert Giffen argued in favor of establishing a common measure of prices in different countries. Mr. Bateman, of the English board of trade, touched another important point when he presented the question of how to establish a better basis than now exists for the comparison of the trade statistics of various countries.

## THE MEETING OF THE ECONOMIC AND HISTORICAL ASSOCIATIONS.

THE fourth annual meeting of the American historical association, and the second annual meeting of the American economic association, opened at eight o'clock on Saturday evening, May 21, in Huntington hall, of the Institute of technology, Boston. Among the members of the associations present were Francis A. Walker, Justin Winsor, Alfred Emerton, Dr. F. W. Taussig, Prof. C. F. Dunbar, and Prof. W. W. Goodwin, of Harvard; Prof. A. T. Hadley of Yale; Profs. R. M. Smith, F. J. Goodnow, E. M. Smith, N. M. Butler, and E. R. A. Seligman, of Columbia; Prof. Alexander Johnston of Princeton; H. C. Adams and ex-President A. D. White of Cornell; Profs. E. J. James and C. J. Stillé of Philadelphia; Profs. H. B. Adams and R. T. Ely of Baltimore; Dr. Philip Schaff, Judge C. A. Peabody, Hon. John Jay, and General Cullum, of New York City.

President Walker's opening address was a brief analysis of the present industrial status. He followed the development of thought with reference to the manual-laboring class, and pointed out the sources of our present industrial troubles. He was most outspoken in condemnation of the boycott and of the methods of the demagogues among the Knights of labor. His appeal for a re-assertion of the spirit of American men and American institutions as against the methods of our immigrant population was forcibly stated, and was greeted with enthusiastic expressions of approval.

President Winsor of the Historical society followed with a scholarly address on the 'Documentary sources of American history.' He told what had been done by Jared Sparks, Peter Force, and George Bancroft for the collection and publication of state documents. He instanced the history of the Trumbull papers as evidence of what vicissitudes important documents might be called upon to pass through. He closed with the practical suggestion, that, before it is too late, the U.S government should establish some body, like the Historical manuscripts commission of England, charged with the task of collating and preserving papers of value for the history of the development of the political life and thought of the country.

After the addresses a reception was tendered the members of both associations by the trustees of the Museum of fine arts, in that building.

On Monday, the 23d, both associations settled down to work. At the morning session of the Historical association a most valuable paper was presented by Judge Mellen Chamberlain of Boston, on "The constitutional relations of the American colonies to the English government at the commencement of the American revolution." Judge Chamberlain's argument was purely legal, and called forth from Professor Johnston of Princeton a few remarks on the relation of the legal to the political argument in considerations of this sort. The other papers of this session were 'Historical grouping,' by James Schouler; 'Diplomatic prelude to the seven-years' war,' by H. E. Mills; and 'Silas Deane,' by Charles Isham.

The corresponding session of the Economic association was devoted to the transportation problem, and developed many points of interest. The standing committee on transportation presented a report which indicated the plan of the work to be undertaken. Professor James of Philadelphia gave an historical *résumé* of the agitation for national regulation of the railways in the United States, and a notice of the Windom report of 1873, and the Cullum report of 1886. The interstate commerce bill he regarded as tentative, but as a step in the right direction.

Dr. Seligman of Columbia followed with the most valuable paper of the session, on the 'Long and short haul clauses of the federal railway law.' Dr. Seligman entered minutely into the subject of railway charges, and explained carefully and clearly the phrase 'what the traffic will bear.' After showing the difference between differential and preferential rates, the speaker defended the former on grounds of public policy, while heartily condemning the latter. Dr. Seligman was very emphatic in his assertion, and very clear in his proof, that the charge for railway service should be based, not on its cost, but on its value. From this principle follow classification and discrimination. Dr. Seligman concluded, "Under a system of free competition among private railways, the principle of volume of service, or charging what the traffic will bear, is the only rational method calculated to give the most efficient service and greatest profits. But the existence or possibility of the abuse of power requires the restriction of this unlimited liberty in the public interest. The reconciliation of the railways and public interest can take place only through the interposition of public authority. The public authority must lay down the rule of equal treatment as the fundamental doctrine, but must recognize the principle of value as a reason for departing from the doctrine in individual cases. Omission of either duty necessarily entails injustice or inefficiency." Simon Sterne, Esq., followed with a paper on European railroads, and an animated discussion ensued, participated in by Professor Hadley of Yale, Simon Sterne, and Edward Atkinson of Boston.

In the afternoon both associations were entertained at Wellesley college by the faculty and students of that institution. At the evening session of the Economic association, Mr. Franklin H. Giddings, editor of *Work and wages*, offered a philosophical paper on the 'Sociological character of political economy.' Hon. John Jay read before the Historical association an essay on the 'Peace negotiations of 1783,' Dr. H. B. Adams gave an interesting account of Ranke's personality and work, and Dr. Francke of Harvard discussed the 'Parliamentary experiment in Germany.'

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## *HEALTH MATTERS.*

MOUNTAIN-CLIMBING. — Dr. L. Barkan of Brooklyn has contributed an article to the *New York medical journal* on the advantages of mountain-climbing. He regards the pure mountain air as one of the best of disinfecting agents. He says there are floating in the air numberless germs, many of them of a harmful nature; and it would seem possible that the injurious germs which, especially in large places, are received into the human organism, might be rendered innocuous by the oxygen of the air, and perhaps also by air-currents acting in a mechanical way, while in stagnant air — as, for example, in a badly ventilated apartment, where the exhalations from the lungs and skin are constantly accumulating — there is less disinfectant action because of the diminished quantity of oxygen. The best inhalation apparatus, baths, and medicaments, are of but temporary value, if no compensation is made for the loss of vitality and of muscular tone, especially that of the heart and vessels; if the blood stasis in the glands and other organs does not yield to an increased flow of blood in the arteries and veins; if the thinned blood does not become thicker and more rich in albumen; if the accumulating carbonic acid is not expelled by a more plentiful supply of oxygen; if the fat deposited in the body is not more rapidly oxidized; and if the kidneys are not made to act more efficiently. All these effects are produced, according to Jacobi, Loomis, Veit, Oertel, and other authorities, more certainly and more generally by mountain-climbing than in any other way whatever. After several weeks spent in mountain excursions, the condition of the patient is radically changed for the better. There is an elasticity of the mental processes in place of the former hebetude; will, thought, and impulse seem to move on wings; the

formerly dull senses are sharpened; the formerly half-closed eyes sparkle, and the flabby cheeks become fuller and rosy; the formerly prominent abdomen is reduced to more seemly dimensions, notwithstanding that food and drink are taken with greater relish; and the chest is expanded. Dr. Barkan thinks the European mountains are to be preferred to those of America, principally on the ground that better paths are provided. He makes an exception to this rule in favor of the Adirondacks and some other mountains in the eastern states. In organizing mountain-parties, every thing should, so far as possible, be previously arranged. Regulations should be established as to the gradual increase in the extent of the daily ascents, the periods of rest, the protection of the feet and other parts of the body against chafing and the formation of blisters. The advice of Dr. Barkan will be found by inexperienced pedestrians to be of great value, and we should advise those who contemplate mountain-climbing during the coming summer to familiarize themselves with his rules of action, and thus save time and avoid suffering.

THE STOMACH. — Dr. A. H. P. Leuf, in an article in the *Medical news* on the stomach, calls attention to several important errors in the anatomy and physiology of that organ as described by most of the authorities. He finds, as the result of many post-mortem and other examinations, that instead of lying in a horizontal position, the stomach in its normal position is vertical, and that when it is distended the lesser curvature remains comparatively stationary, while the greater moves to the left and downward, and the pouch upward and to the left. An empty stomach is in a contracted condition, and assumes a tubular form: gaseous distention, though frequently found, is not the rule, nor is it strictly physiological. When water is taken into the full or partly full stomach, it does not mingle with the food, as we are generally taught, but passes along quickly between the food and the lesser curvature, towards the pylorus, through which it passes into the intestine. The secretion of mucus by the lining membrane is constant, and during the night a considerable amount accumulates in the stomach: some of its liquid portion is absorbed, and that which remains is thick and tenacious. If food is taken into the stomach when in this condition, it becomes coated with this mucus, and the secretion of the gastric juice and its action are delayed. These facts show the value of a goblet of water before breakfast. This washes out the tenacious mucus, and stimulates the gastric glands to secretion. In old or feeble persons, water should not be taken cold, but it may be with great advantage then taken warm or hot. This removal of the accumulated mucus from the stomach is probably one of the reasons why taking soup at the beginning of a meal has always been found so beneficial. Dr. Leuf sums up his views as follows: 1°. The position of the stomach is more nearly vertical than horizontal; 2°. An empty stomach, if in good tone, is always tubular; 3°. A tubular stomach should be the rule on rising; 4°. Non-irritating liquids pass directly through the tubular stomach; 5°. They do likewise if the stomach contains food, and in such cases pass along the lesser curvature; 6°. The morning mucus contained in the stomach hinders or retards digestion; 7°. Water drank before meals dilutes and washes out this mucus, stimulates the gastro-enteric tract to peristalsis, and causes hyperaemia of its lining membrane, thus greatly aiding digestion as well as elimination; 8°. Cold water should be given to those who have the power to react, while warm or hot water must be administered to all others; 9°. Salt added to the water is very beneficial in preventing the formation of unabsorbable parapeptones; 10°. It is perfectly proper to drink water before, during, and after meals.

CETTI'S FAST. — M. Cetti, who began a fast of thirty days at Berlin, maintained it but two weeks, having been assured that a longer deprivation would be of no scientific value. During the fast he was under the observation of such scientific men as Virchow and Senator; and the results, when published, will undoubtedly be of great interest. He drank all the water he desired, and was permitted to smoke cigarettes. His average daily loss in weight was 585 grams. Accurate measurements of the body were taken, and minute analyses of the excreta made from time to time: also examinations of the blood and sphygmographic tracings of the pulse. Estimations were also made of the amounts of oxygen absorbed, and of carbonic acid produced, during respiration.

WATER-SUPPLY AND TYPHOID-FEVER. — Dr. Charles Smart, surgeon U.S.A., regards the water-supply as the principal medium of the transmission of typhoid-fever, and refers to the statistics of New Orleans and Philadelphia as sustaining his views. In the former city, without a sewer system, the drinking-water is pure rain-water; while in Philadelphia, with a sewer system, the water-supply is contaminated. The death-rate per 100,000, from typhoid-fever in New Orleans, in 1866 was 68, and in 1885 but 16; the average for the first decade, 1866-76, being 41.3, and for the second, 24.6, a decrease of nearly 17. In Philadelphia the average for the first decade was

, 66.1, an increase of nearly ... the statistics, it would seem ... transmission of typhoid-fever by means ... is overlooked. In Brooklyn the out- ... 1885 was distinctly traced to communi- ... through sewers, and it was also fairly well ... trated that the water-supply played no ... all in the transmission of the disease. ... ct is undoubtedly that typhoid-fever is com- ... icated both by means of sewers and the water- ... ly, and that neither is to be regarded as the ... factor in its propagation.

ASTEUR'S WORK. — Pasteur is at the present ... being very severely criticised by his oppo- ... s, some charging him with causing the death ... his patients by his inoculation experiments. ... following table of statistics, taken from the ... et, would seem to indicate, that, notwith- ... ing the adverse criticisms, Pasteur's claims ... ving saved life are established on a substan- ... asis.

| | No. of cases treated. | Deaths from all causes. | Mortality. |
|---|---|---|---|
| aris | 2,730 | 45 | Under 2 per cent |
| sa | 325 | 12 | " 4 " |
| tersburg | 118 | 1 | " 1 " |
| oscow | 112 | 2 | " 2 " |
| Vienna | 96 | 0 | – |
| Warsaw | 84 | 0 | – |
| Naples | 48 | 0 | – |
| Samara | 47 | 2 | Under 5 per cent |
| | 3,560 | 62 | Under 2 per cent |

These statistics include those treated up to the close of 1886. Since then, twelve or fifteen more deaths have occurred, making the total mortality less than 80, or 2¼ per cent. In contrast with this, we find the rate of mortality after bites of rabid animals to be about 16 per cent; or, in other words, the treatment pursued by Pasteur and those who have practised his method elsewhere, has been followed by but one death, while without the treatment there would have been seven deaths, per thousand.

GEOGRAPHICAL DISTRIBUTION OF CONSUMPTION. — The New Sydenham society has recently published the third volume of Hirsch's 'Handbook of geographical and historical pathology,' in which the author treats of pulmonary phthisis. He finds the disease to be one of all times, countries, and races. Its mortality is 3 per 1,000, or nearly one-seventh of the total mortality. In Vienna the rate is 7.7 per 1,000; in Berlin and Dresden, but 3.8. Among nomad tribes, the Kirghiz of Central Asia and the Bedouins of Arabia, phthisis is almost unknown. When, however, these tribes change their abodes and dwell in towns, then the disease appears among them. The conclusions of Professor Hirsch are as follows: 1°. Phthisis is everywhere prevalent, but it is rare in polar regions, and rarer still at high altitudes; 2°. The main factors in its production are over-crowding and bad hygiene; 3°. Heat and cold, *per se*, have no influence: 4°. Damp, when conjoined with frequent oscillations of temperature, predisposes to the disease, but humidity of the air is less important than dampness of soil; 5°. Occupation is extremely important, but mainly indirectly, as tending to good or bad hygienic conditions.

WHOOPING-COUGH. — At the sixth German congress for internal medicine, held at Wiesbaden in April, the subject of whooping-cough was discussed. Professor Vogel of Munich regards the disease as infectious. In an epidemic which occurred at Wurzburg, 52 children under one year of age were affected, and 13, or 25 per cent. died; 248 between one and five years were also affected. Of this latter number, 12, or 4 8 per cent. died; while between the ages of six and fifteen years there were 87 cases, of which but one case, or 1.1 per cent, was fatal. Professor Hagenbach of Basle said that 240,000 children in Germany have this disease annually; the mortality being, on the average, four or five per cent. He regards it as communicable so long as much mucus is produced. Schools should be most carefully watched, and children who have paroxysmal coughs should be excluded; and, if the disease occurs and spreads, the schools should be closed. The moving of children from place to place for change of air is often the cause of an epidemic in places free from the disease.

## MENTAL SCIENCE.

### *Para-psychology.*

WHEN, through disease of the nerves or the action of drugs, the sense-organs lose their sensibility, the state thus produced is called 'anaesthesia;' when, for similar reasons, their activity is unduly heightened, the condition is spoken of as 'hyperaesthesia;' and when the abnormality of sensation consists in the production of unusual effects by ordinary stimuli (for example, when every touch is regarded as the creeping of an ant

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over the skin, or when the two points of a compass seem as three), the condition is termed 'paraesthesia.' By analogy the term 'para-psychology' may be invented to apply to those weirdly imaginative systems of thought by which some intellects strive to satisfy their inner longings, and to make the world seem rational. For these persons the advance of science has no meaning; to them it is simply painfully slow and accurate walking; while their ideal of locomotion is flying in a frictionless ether.

An exquisite example of this type of mind (which, by the way, often contains a kernel of sound truth) is exhibited in a recent attempt to portray the evolution of human consciousness in a series of highly symbolic and complex geometrical diagrams. The author of the work began his career as an architect, but, dissatisfied with his profession, went to India to pursue 'the study of internal truth,' and spent twenty years in completing this elaborate system of symbolism. A frank admission, that, like many of the persons to whom these diagrams were shown, the present writer does not understand them, will readily excuse him from giving an exposition of their meaning. All that can be done is to piece together a few sentences from this geometrical symbolism. There are five standing-grounds of human evolution, — from the first, representing sense-perception; to the second, which is merely negative and unrepresentable; to the third, the sphere of self-sacrificing duty and spiritual enlightenment; to the fourth, again an unthinkable negative stage; culminating in the fifth, a stage, though positive, yet so ideally spiritual as to entirely surpass our finite conceptions, and only glimpsed perhaps now and then by a supersensitive clairvoyant. The first stage is represented by a plane; the third finds its representation in three dimensions; while the fifth would require a fourth dimension to do it justice; the intermediate negative stages being entirely unrepresentable. On the first plane the forms take the shape of leaves; a pointed apex indicating a male form, or Ond, while a rounded apex indicates the female form, or Onde. The limit of the one is a straight line, the symbol of severe intellect; of the other, a circle, symbolizing all-embracing emotion. In the third stage the leaves become flowers, with trumpet-shaped corollas for the males, and bell-shaped for the females; with colors suggested by spinning the plane forms (cut out of cardboard) in a dark room illuminated by a beam of light, and a host of symbolic details mirroring nothing less than the entire history — past, present, and future — of the human race. Add to this a painstaking forcing of all these botanical forms by a fanciful application of arithmetical, geometrical, and harmonic progressions; intersperse this with a sprinkling of theosophic cant and vague word-philosophemes, — and some notion of this para-psychological system will perhaps result. If not, it is only necessary to add, that the author has frequently drawn horoscopes, has discovered that our solar system is a male universe and is represented by the use of this geometry by a nine-petaled lily, while the earth (*mirabile dictu*) finds its symbol in a form like ♁, which was actually used by astronomers for this purpose.

That all this is full of life and meaning to its author, and will be suggestive to many readers, there is no reason to doubt; any more than there is to doubt that he was unconscious of forcing his diagrams into the shape of leaves and flowers instead of their teaching him that each heavenly body was mirrored in a plant below.

Apart from the sad spectacle of misused talent (and that can be seen in any insane-asylum), the survey of such a system emphasizes by contrast the moral value of logical method, and illustrates the great dangers of mono-ideism, and of that unchecked imagination which has prepared so many victims to the snares of a mad symbolism.

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THE COMPARATIVE INTENSITY OF SENSATIONS. — M. Bloch has compared the relative strength of sensations by finding which of two exactly simultaneous sensations is perceived first. He first had a bell struck and a white paper appear nearly at the same time, and found, that, if the sound comes $\frac{1}{36}$ of a second before the white streak, one heard before one saw. If the two are still closer together, they seem to be simultaneous, and remain so until the streak is $\frac{1}{25}$ of a second before the sound, when the sight precedes hearing; so that within these limits ($\frac{1}{36}$ of a second before, and $\frac{1}{25}$ of a second after) there is practical simultaneity. From this is calculated that it takes $\frac{1}{72}$ of a second longer to hear a sound than to see a sight. From a similar series of experiments it was found that it took $\frac{1}{21}$ of a second longer to feel a touch than to see a sight; so that the order of intensity — meaning by this the power a sensation has to attract attention and get first into consciousness — is sight, hearing, touch.

THE BLIND IN CHINA. — Mr. W. H. Murray, an Englishman, has been the means of introducing into China a system of writing the Chinese characters in raised print. When we consider the complexity and multitude (about four thousand) of Chinese characters, and remember that the smallest of China's eighteen provinces is equal in ex-

tent to England (and England has forty thousand blind), the vastness of this philanthropic work will be apparent. Mr. Murray noted the actual sounds used in speaking Chinese, and succeeded in reducing these to four hundred, each being represented by a different arrangement of dots. He tried his first experiment on a blind beggar taken from the streets, and in six weeks taught the boy to read, and even to write a little. The fame of this experiment soon spread, and pupils crowded to be taught. The system was extended to include music and to adapt itself to the various dialects, — no mean task, since the Bible must be printed in eight different sets of characters to be understood all through China.

## EXPLORATION AND TRAVEL.

### Danish explorations in East Greenland.

It is stated in Copenhagen, says *Nature* of May 5, that an expedition will be despatched late this summer by Herr A. Gamil, the equipper of the Dijmphna expedition of 1882, to the north-east coast of Greenland. It is hoped that the explorers may reach a higher latitude than that attained by Lieutenant Holm in 1884. The expedition will be commanded by Lieutenant Hovgaard, who in 1882 commanded the Dijmphna.

It will be remembered that Holm made a successful exploration of the east coast as far as latitude 66° 20′ north in 1884 and 1885. He started from the west coast in several Eskimo boats, and, by the help of the natives, reached the fiord of Angmagsalik. His observations on the ice phenomena of this coast show that the sea is probably navigable during a great part of the year. There is little or no ice close to the coast in the autumn and during the early part of winter. In January and February heavy masses of ice lie close to the shore, and remain there until late in spring. In June or July they begin to disappear. From these observations, it appears that the coast can be reached by vessels late in the season, and the new expedition will probably make use of this experience. It is a remarkable fact that in arctic America those places are most easily approached where the coast makes a slight outward turn, while concave bends of the coast are always difficult to approach. The east coast of Greenland was reached by Scoresby near Scoresby Sound, and by Nordenskjöld at Cape Dan. At both points the coast makes a turn. South of Cape Dan we find a slight concave bend, which is always filled with closely packed ice. The same fact may be observed in Baffin Bay and Davis Strait. The bay of Julianehaab is always full of ice, and the land cannot be reached here, while farther north there is only loose ice under the coast. The west ice of Baffin Bay can be crossed most easily near Cape Walsingham and Cape Kater, — the middle water of the whalers. This phenomenon is easily accounted for : on the straight or concave coast the ice is pressed against the land, while on the points there is room for it to spread out. There are many questions of great interest to be solved on this coast, — the extent of the inland ice, an; exploration of the enormous sounds of Scoresby Land and King William Land, and the northern limit of man. On his visit to East Greenland, Scoresby met Eskimos in latitude 70° north. The German expedition of 1869-70 found the ruins of their houses at the farthest point reached. Many facts make it probable that the Eskimos travelled around the north point of Greenland ; and therefore a study of the most northern tribes of the east coast is of particular interest from an ethnological point of view, and for the decision on the feasibility of the exploration of the north coast of Greenland.

### Polar regions.

According to the Proceedings of the Royal geographical society for May, Sir Allen Young, the well-known arctic explorer, has offered his services to the Australian colonies to lead an expedition to the antarctic regions. Acting on this offer, Sir Graham Berry has brought the question of a government grant towards the cost of the enterprise (stated to be $40,000) before the cabinet, and the matter is being urged forward with a view to the vessel or vessels starting from Hobson's Bay in October or November next. The object of the expedition is to be entirely geographical, but incidentally much advantage is expected to accrue to the whaling and sealing interests, which would profit by the information gained. While thus an important further step has been taken to promote the Australian expedition, it seems that the reports on Nordenskjöld's plans were not well founded. It may be that he plans an expedition towards the south pole, but so far no funds are available for this purpose.

The season of arctic travels is also approaching. Mr. K. D. Nosilof, a Russian explorer, announces to the French geographical society (*Compt. rend.*, No. 7, 1887) his intention to visit Nova Zembla. Nosilof has spent three years in exploring the northern Ural to find a practicable route to Siberia. This was done at the expense of Mr. Sibiriakof, who has given up his intention of establishing regular communication by sea between the Obi and Archangel. On his new expedition, Nosilof intends to make a detailed survey of the coasts and of the interior, and to study the

movements of the ice of the Kara Sea. Besides, he intends to study the natural history and ethnology of that district.

In America, Colonel Gilder is going to resume his work, which was interrupted last winter. He intends to return to Hudson Bay, and to start on his expedition north with the Eskimos of Wager River, with whom he became well acquainted at the time of Schwatka's sledge-journey to King William Land, of which he was a member. He hopes to be able to reach Iglulik, in Fury and Hecla Strait, in the spring of 1888, and Lancaster Sound in the summer or autumn of the same year.

## *NOTES AND NEWS.*

THE department of agriculture has issued a paper prepared by Professor Riley, on the defoliation of shade-trees in Washington. The four principal leaf-eaters are the imported elm-leaf beetle, the bag-worm, the white marked tussock moth, and the fall web-worm. The beetle, Professor Riley says, has done much mischief in the old world. It was first imported here in 1837, and its earlier destructive attacks were notably about Baltimore and New Jersey. The bag-worm for two or three years has been on the increase in special localities in Washington. Speaking of the enemies of these worms, he says, "The 'pellets' of a screech-owl found in the vicinity of Baltimore consisted apparently almost entirely of the hairs of these caterpillars, proving that this useful bird has done good service. Perhaps the statement may be of interest that this little owl is getting much more common in the vicinity of cities in which the English sparrow has become numerous, and that the imported birds will find in this owl as bold an enemy as the sparrow-hawk is to them in Europe, and even more dangerous, since its attacks are made toward dusk, at a time when the sparrow has retired for the night, and is not as wide awake for ways and means to escape. If our two cuckoos, the black-billed and yellow-billed species, could be induced to build their nests within the city limits or in our parks, we should gain in them two very useful friends, since they feed upon hairy caterpillars." Speaking of a remedy for these pests, Professor Riley says, "It so happens, fortunately, that there is one thoroughly simple, cheap, and efficacious remedy applicable to all four of these tree-depredators. They all begin their work very much at the same season, or as soon as the leaves are fairly developed; and arsenical mixtures properly sprayed on the trees about the middle of May, and repeated once or twice at intervals of a fortnight later in the season, will prove an effectual protection to trees of all kinds."

— A committee of the Association of German physicians has sent a circular to the directors of all the gymnasia of Germany, asking them to dissuade students from adopting the medical profession. Accompanying the circular are statistics which show the proportion between the number of physicians licensed each year and the number who die or retire from the profession.

— A second edition of Lancaster's 'Liste des observatoires et des astronomes' has appeared. We are glad to learn that there is a prospect of further editions being published, as they may be required to keep pace with the movements of astronomers. This little directory will be found useful not only by astronomers, but by booksellers and others who may wish to be put in communication with the astronomical world. The index contains about a thousand names.

— Trübner & Co. announce the first volume of the 'Reports of the Archeological survey of southern India, the Amarâvatî and Jaggayyapeta Buddhist Stûpas,' by James Burgess, director-general of the Archeological survey of India; together with transcriptions, translations, and elucidations of the Dhauli and Jaugada inscriptions of Asoka, by Prof. G. Buhler, Vienna. Dr. Burgess, the director-general of the Archeological survey of India, is just finishing a volume on the Amarâvatî and Jaggayyapeta Stûpas, illustrated by more than fifty collotype and lithographic plates and numerous woodcuts. It will be remembered that the second part of the late Mr. James Fergusson's 'Tree and serpent worship' (now out of print) dealt with the marble sculptures brought by Col. C. Mackenzie and Sir Walter Elliot at different times from the Amarâvatî Tope or Stûpa, and which are now in the British museum. Dr. Burgess spent some time at Amarâvatî immediately after the excavation of the site by orders of the Madras government, where he made further researches, discovering about ninety fresh sculptures, and forwarded about a hundred and eighty slabs to the Madras government museum, which he also carefully photographed. On the spot he made many drawings, and copied all the Pali inscriptions, which are numerous, and, though short, are of considerable interest. One in particular he discovered, bearing the name of Pulumâyi, one of the great Andhra sovereigns of the second century, which is of the utmost value in determining the age of the Tope. The date of the monument proves to be earlier by about a century and a half than Mr. Fergusson had estimated it; but this seems to be solely due to the

want of date, when the latter wrote, by which to fix the age of the Nasik inscriptions of the Andhra kings. It is one evidence of the value of the epigraphical researches by the Archeological survey that they enable scholars to determine, within so very narrow limits as Dr. Burgess is understood to prove, the age of so interesting a monument as this of Amarâvatî. At Jaggayyapeta, a large village farther up the Kistna River, and close on the Hyderabad frontier, Dr. Burgess discovered another ruined Stûpa. This is also described and illustrated, and the inscriptions from it translated. Though much smaller than that at Amarâvatî, it proves to be of much earlier date; and its very archaic sculptures, though few and much injured, are of the greatest interest in the illustration of early Indian art. The work is all in type, and only waits the completion of some of the plates, which may be expected within a short time.

— The garbage crematory at Wheeling, W.Va., is said to be completed, and to have stood the tests which have been applied, to the satisfaction of the authorities. Pittsburgh, Penn., is also endeavoring to solve the difficult problem of the disposal of garbage, and has advertised for bids to construct furnaces. We regret to learn that the Milwaukee, Wis., authorities have decided to remove the garbage of that city to the country, and there bury it in the ground. Such a method of disposal is, at the best, unsanitary, and can be but a temporary relief.

— Dr. Albert Kellogg, the pioneer botanist of the Pacific coast, and the last surviving charter member of the California academy of sciences, died at Alameda, March 31, 1887.

— The U. S. coast-survey parties on the Pacific coast are now all in the field. Assistant Pratt, on the west coast of Washington Territory, will complete the astronomical and plane-table reconnaissance from Cape Flattery to Gray's Harbor, over a region which has been traversed by few persons, and has been absolutely unsurveyed except for the hydrographic reconnaissance made by Captain Alden early in the fifties. The preliminary astronomical and topographical reconnaissance and survey along the coast of Washington Territory from Columbia River to Port Orford, under the charge of Assistants Rockwell and Dickens, will also be completed this year. The magnetic apparatus at Los Angeles is giving splendid results, almost unbroken curves having been maintained at this station for several years. Every great earthquake which has occurred has affected the magnetic elements, and has been faithfully recorded, some of the waves in lines of the record being quite remarkable. The steamer Blake, on her way from the Gulf Stream explorations which have been in progress on the south of Key West, will call at Brunswick harbor, Georgia, and make an examination of that bar, at the request of citizens interested in the progress of the port. The Blake will also stop at Cape Fear, and will make a hydrographic survey in that vicinity, where remarkable changes have occurred in the last twenty years. Two topographic parties and one hydrographic party are now at work on the coast of Maine in the vicinity of Cobscook Bay. The surveys on this coast are rapidly approaching completion.

— Commercial Agent Smith reports from Mayence that the peronospora, which is a pest as rapacious as the phylloxera, has made its appearance in the vineyards of Germany, threatening to accomplish on the Moselle and Rhine what the phylloxera has failed to effect, — the destruction of the vineyards on the banks of those rivers: and the vine-dressers are filled with alarm for the future. The chamber of commerce at Coblenz has called the attention of the government at Berlin to the pest, and asks that the remedy adopted in America, of burning the leaves upon which the insect has fixed itself, be employed by the police.

— The navy department has just issued a fine submarine cable chart of the world.

— The U. S. fish commission sent a car last week with 4,000,000 shad-eggs and 1,500,000 shad-fry to New York state for stocking the waters of the Hudson River.

— The international convention just ratified by the President, securing patentees in the United States the right to take out patents in other countries at any time within seven months after letters have been issued to them by our government, confers a privilege which will be highly valued by inventors.

— Lieut. John P. Finley of the signal office has just issued a new publication on the subject of tornadoes.

— Gen. A. W. Greely, chief signal officer, has received from the secretary of war a gold medal presented to him by the Paris geographical society, in recognition of his valuable contributions to the knowledge of high latitudes.

— In May, 1887, Messrs. Ticknor & Co. begin the publication of a set of handsome and convenient paper-covered volumes, for leisure-hour and summer-day reading, to be made up of some of the choicest and most successful novels of late years, together with several entirely new novels by well-known and popular writers. They will be issued regularly, once a week, for three months.

— Prof. W. G. Peck, LL.D., is writing an 'Analytical mechanics' for the use of colleges and scientific schools, embracing the course as now taught at the School of mines, Columbia college. Messrs. A. S. Barnes & Co. will publish it in the early summer.

— Messrs. Ticknor & Co. announce for publication 'The Nigritians,' division 1 of 'The social history of the races of mankind,' by A. Feathermann; also 'The Melanesians,' division 2 of 'The social history of the races of mankind,' by A. Feathermann. These two learned volumes are parts of the great group which was begun by the publication of 'The Aramaeans' two years ago. When all the volumes of 'The social history of the races of mankind' shall have been published, the work will be found to be a comprehensive history of universal civilization, embracing not only the civilized and most enlightened nations of the earth that exist now, or had existed in the remotest ages, but treating equally of savage and barbarous races, tribes, and nations, such as are historically known to have existed in ancient time, and such as exist now in Africa, Oceanica, America, in the north of Europe, and in many parts of Asia.

## *LETTERS TO THE EDITOR.*

***The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The cause of consumption.

IN regard to the so-called 'theory of consumption' developed by Hambleton, as described in a recent number of *Science* (ix. No. 221), I think that our knowledge of the cause of tuberculosis is now so definite and precise that communications of that nature are positively pernicious, if not made with more discrimination, because they confound the cause of the disease with the favoring or retarding influences under which it may progress, and thus draw off attention from one of the most important measures which must be taken to guard against the contraction and perpetuation of the disease.

It is now definitely established that tuberculosis is caused, and caused alone, by the presence and action in the body of the bacillus tuberculosis. Tuberculosis can no more appear in the body without the previous entrance of the bacillus than a crop of corn can spring up in the soil without the previous deposition in some manner of the seed. And to gravely discuss the probability of tuberculosis originating in the body from any set of conditions not associated with the bacillus tuberculosis is precisely analogous with speculations as to the conditions of soil, climate, etc., which could cause a crop of corn to spring up spontaneously in a field.

As your correspondent 'Medicus' points out, Hambleton's array of facts affords strong confirmatory evidence of the infectious nature of the disease, and shows the important influence on the development and progress of the disease of certain external conditions of individuals and people.

Before the discovery of the bacillus tuberculosis, such hypotheses as Hambleton's were frequently elaborated, and were useful as the best which could be done at the moment. The facts upon which they were based are still more useful to-day, but conclusions from them should not be permitted to assume a false relationship to the real causative agent in tuberculosis.

At present it does not seem probable that tuberculosis, when once definitely established in the body, can be successfully combated by the administration of drugs for the direct destruction of the bacilli, although new methods of treatment based upon this possibility are frequently suggested, and find one after another a short-lived currency. It appears very doubtful whether the body can be sufficiently saturated with any form of germicide to insure the complete destruction of the bacilli without destroying the life of the individual.

But, on the other hand, much has been, and much more may still be, done in the way of assisting the cells of the body in their natural warfare against the invaders; as by the supply of suitable foods and the furnishing of favorable hygienic and climatic conditions. Heredity is, without doubt, an important element in the origin and progress of the disease, but it is unquestionably not a directly etiological but only a secondary determining or accessory factor.

When the public and the members of the medical profession are sufficiently impressed with the overwhelming importance of the primary infection of the body with the bacillus tuberculosis — apparently in most cases from inhalation with dust of the bacillus or its spores — in the causation and perpetuation of the disease, and are thereby led to urge and practise the universal destruction or disinfection of sputum and all other discharges from tuberculous individuals, we shall have taken the first step towards what appears to be our only real and well-grounded hope of effectually stamping out the disease. The safeguards which we provide, or ought to provide, against the invasion of Asiatic cholera, consist in the destruction of the bacterium which causes it, and although far more difficult of accomplishment, owing to its constant and universal presence, this is the task to which we must address ourselves in the face of the far more important disease, tuberculosis.

In the event of an invasion of Asiatic cholera, we should indeed consider and attempt to guard against those conditions which seem to render an attack of the disease more likely, such as digestive disturbances, over-exertion, etc., and we should bring all accumulated experience to bear upon the conduct of the disease in the individual to a successful termination. But, after all, the main direction of our efforts would lie in precautions against its spread, and the speedy stamping-out of the disease by rigid disinfection of all excretory material. In other words, while the conduct of individual cases would not be neglected, we should realize that in the wider task of total eradication lay our chief duty.

Now tuberculosis is domesticated among us, and the dramatic and absorbing features of a more rapidly fatal and readily acquired disease are wanting; so that, while we are busying ourselves in the humane and worthy effort to help the stricken individual, the spread of the disease among more vulnerable persons goes steadily on, and systematic efforts towards the prevention of the distribution of infective material are almost completely ignored.

Let all the conditions which Hambleton and others urge — mistakenly, I think, as the cause of the disease — be fully considered and guarded against; let climatic, hygienic, and hereditary influences be made as favorable as possible; and let the influence of drugs be brought to bear whenever and however they safely and to good purpose may. To attend to these things is the duty of the physician. But beyond and above all this, is the problem of the total eradication of the disease. Its practical solution may and probably does lie far in the future; but it would seem unquestionable, in the light of modern science, that any systematic and intelligent effort in this direction must be based first of all on the universal recognition of the fact that a particular species of bacterium, and it alone, causes tuberculosis, although there are hosts of most important external and internal conditions which favor or retard the progress of bacterial invasion.

T. MITCHELL PRUDDEN, M.D.

New York, May 23.

## Bassariscus, a new generic name in mammalogy.

Having lately had occasion to do with the quadruped commonly called Bassaris astuta, my attention has been drawn to the fact that the generic name is pre-occupied in entomology. It is said to have been conferred by Hübner upon a genus of lepidopterous insects, 1821 or earlier. There being no synonyme of the mammalian genus, that I know of, a new name for the latter seems to be required. The above may be regarded as a diminutive of one of the several forms of a Greek word meaning fox, and the two species of the genus may be known as Bassariscus astutus and B. sumichrasti. The English equivalent would be 'bassarisk,' a term which may come into use, since we have not yet any single word in the vernacular as the name of the animal. As to the technical name of the family of bassarisks, it may be observed, that, if Bassaris be untenable in this connection, then so is Bassarididae. The first tenable generic name in this family is doubtless Bassaricyon of Allen, 1876, whence it would appear that the proper name of the family is Bassaricyonidae.

ELLIOTT COUES.

Smithson. inst., Washington, May 14.

## A needed invention in coal-mining.

In recommending air-jigs for separating coal from slate, I fear that Mr. Ludlow (*Science*, May 13) is on the wrong track. Two solids are readily separated by a fluid whose specific gravity is intermediate between theirs: the heavier sinks, the lighter floats. But if, as is usually the case, we must employ a fluid lighter than either, the heavier that fluid the more ready and complete the separation: hence the enormous disadvantage under which air suffers as a separating medium. Air-jigs, too, would probably break the coal much more than water.

Coal initially dry would suffer an apparently irreparable injury from absorption of water, if separated by wet jigging; but, for coal initially wet, means for using the waste water over and over apear to offer a more promising field than air-jigs.

HENRY M. HOWE.

Boston, May 17.

## A noteworthy specimen of Devonian lepidodendron.

A noteworthy specimen of Devonian lepidodendron (L. primaevum Rogers?) has recently been added to the New York state museum of natural history at Albany. It is fifteen feet in length from the roots upward, measures thirteen and a half inches in diameter across the base, three inches at the broken upper extremity, and preserves in great beauty and perfection the cicatrices of the leaves, in places the narrow elongate-lanceolate foliage and the delicate rootlets.

The fossil was discovered in the Portage arenaceous shales of Naples, Ontario county, N.Y., by Mr. D. D. Luther of Naples and Mr. J. M. Clarke of Albany; and a portion of it, as much as had at that time been excavated, was described in Bulletin No. 16 of the U. S. geological survey. The continuation of the excavation added greatly to the length of the specimen, and exposed its base and roots. The trunk has been flattened in the shales and its tissue reduced to coal, but in its present condition it undoubtedly offers to paleo-botanists one of the most striking examples known of this genus of plants. It is interesting to observe, that, so wide a variation exists at different distances from the base in the arrangement of the cicatrices, one cannot but feel, upon examining the fossil, that, if it had been found in fragments taken from different spots, it would furnish all the necessary material for a half-dozen distinct species of lepidodendron, according to prevalent methods of determining these values. Moreover, towards the base the leaves are uniformly arranged on elevated longitudinal ridges, as in Sigillaria, showing nothing of the quincunx arrangement apparent higher up, and regarded as a diagnostic character of lepidodendron. In this region also the longitudinal ridges are interrupted by a series of varices suggestive of an equisetaceous mode of growth.

While it is to be regretted that the summit of the tree has been lost, it is a fortunate circumstance that preserved to science so fine an example of Devonian forest-growth.

C.

Albany, May 18.

## The Sonora earthquake.

In the report of the earthquake sent you a day or two ago, I think an error was made in the time stated. It should have been 2.48 local time, and 2.13 standard. Additional data and information are at hand, which I have not had time to carefully consider, but which only confirm my previous assertions. There was *no* great loss of life anywhere, all reports to the contrary notwithstanding. The central area of disturbance was about the Fronteras valley, and likely due to faulting. No *eruptive* disturbance has reliably been reported, and I can only iterate my previous assertion concerning volcanic action.

G. E. GOODFELLOW.

Tombstone, A. T., May 14.

## Calendar of Societies.

*Philosophical society, Washington.*

*May* 21. — C. E. Dutton, A recent visit to the scene of the Charleston earthquake and resulting conclusions; W. H. Dall, South Florida notes.

*Anthropological society, Washington.*

*May* 17. — Tatui Baba, The feudal age in Japan, with illustrations; Japanese arms and military organization.

*Chemical society, Washington.*

*April* 14. — F. W. Clarke, The nature of the chemical elements; C. A. Crampton and T. C. Trescott, The estimation of carbonic acid in malt liquors.

*May* 12. — T. H. Chatard, Prospective development of the western alkali deposits; W. S. Yeates, Crystals of celestite from Libery Hill, Texas; W. H. Seaman, On chemical patents; F. W. Clarke, A new relation in the mica group.

*Biological society, Washington.*

*May* 14. — Marshall McDonald, The causes of certain failures in the culture of the Salmonidae; C. V. Riley, Notes on southern California; P. L. Jouy, A bird new to Japan (Pitta oreas Swinhoe), from the Island of Tsushima; F. H. Knowlton, The recent shower of pollen in Washington, — the so-called 'sulphur-shower;' W. B. Barrows, Engineer G. W. Baird, and others, Does the flying-fish fly?

*Engineers' club, Philadelphia.*

*May* 7. — Lewis N. Lukens, Some remarkable breaks in a reservoir; S. C. McCorkle, Exhibition of a map of the rivers in the vicinity of New York, made for commercial purposes.

*Boston society of natural history.*

*May* 18. — J. H. Emerton, New England Ciniflоridae, a family of spiders.

*Torrey botanical club, New York.*

*May* 10. — E. E. Sterns, Notes on some abnormal forms of Saxifraga Virginiensis; N. L. Britton, Notes upon Populus heterophylla.

*Denison scientific association, Granville, O.*

*April* 16. — Messrs. Herrick, Jones, and Tight, Discussion of the geology and lithology of Lake Superior.

*May* 7. — J. L. Deming, Some American and European Ostracoda; A. F. Foerste, Eastern museums; Retrorse buds in the rhizomas of the dog-tooth violet; C. L. Payne, The provisions for cross-fertilization in lobelia; C. J. Herrick, The protogynous flowers of Asarum, with some observations on cross-fertilization in other members of the family.

*Indiana academy of science.*

*May* 19. — T. C. Mendenhall, Weather-prediction; Discussion of the natural history of the Shades of Death.

*Engineers' club, St. Louis.*

*May* 4. — E. D. Meier, Evaporative efficiency of boilers.

*Texas state geological and scientific association*

*March* 8. — Discussion on the coal and iron of Texas.

## Publications received at Editor's Office, May 9-21.

AMERICAN public health association, award made at the thirteenth annual meeting of the, Washington. Dec. 10, 1885. (Lomb prize essays.) 2d ed. Concord, N.H., Repub. pr. assoc. 198 p. 8°.

ANTHROPOLOGY, miscellaneous papers relating to. (Smithson. rep. 1885.) Washington, Government. [44] p. 8°.

BROWNE, L., and BEHNKE, E. Voice, song, and speech. 7th ed. New York, Putnam. 248 p. 12°. $2.

COOK, A. M. Macmillan's Latin course. First year. New York, Macmillan. 341 p. 16°. 90 cents.

DRESS: a monthly magazine devoted to the practical and the beautiful in women's and children's clothing. Conducted by Annie Jenness Miller. Vol. i. No. 1. New York, The Gallison & Hobron co. 48 p. 8°.

ESOTERIC, the. Vol. i. No. 1. *m.* Boston, Esoteric publ. co. 31 p. 8°. $1.50.

FOWLER, T. The principles of morals. Part ii. Oxford, Clarendon pr. 370 p. $2.75.

LOCK, J. B. Dynamics for beginners. New York, Macmillan. 178 p. 16°. $1.

MARILAUN, K. v. Allgemeine Naturkunde. Heft 1, lief. 73–82: Pflanzenleben. Leipzig, Bibliographische institut. 480 p. 8°.

MARSH, O. C. Dinocerata: a monograph of an extinct order of gigantic mammals. (U. S. geol. surv., monogr. x.) Washington, Government. 243 p., pl. 4°.

NEWTON, J. K. Obligations of the United States to initiate a revision of treaties between the western powers and Japan. Oberlin, O., The author. 70 p. 8°.

NEW YORK. Department of public instruction. Thirty-third annual report of the state superintendent, for the school-year ending Aug. 21, 1886. New York, State. 871 p. 8°.

STEWART, B., and GEE, W W. H. Lessons in elementary practical physics. Vol. ii.: Electricity and magnetism. New York, Macmillan. 497 p. 16°. $2 25.

STUART, G. First year in Latin. Philadelphia, Eldredge & Brother. 272 p. 16°.

TECHNOLOGY quarterly. Vol. i. No. 1. September. Boston, Mass. inst. technol. 94 p. 8°.

VAUGHAN, V. C. Healthy homes and foods for the working classes. Lomb prize essay. (Amer. pub. health assoc.) Concord, N.H., Repub. pr. assoc. 62 p. 8°.

WATSON, I. A. Milk from a sanitary stand-point. Manchester, N.H., J. B. Clarke. 15 p. 12°.

# SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 27, 1887.


## *POLITICAL GEOGRAPHY OF CENTRAL AFRICA.*

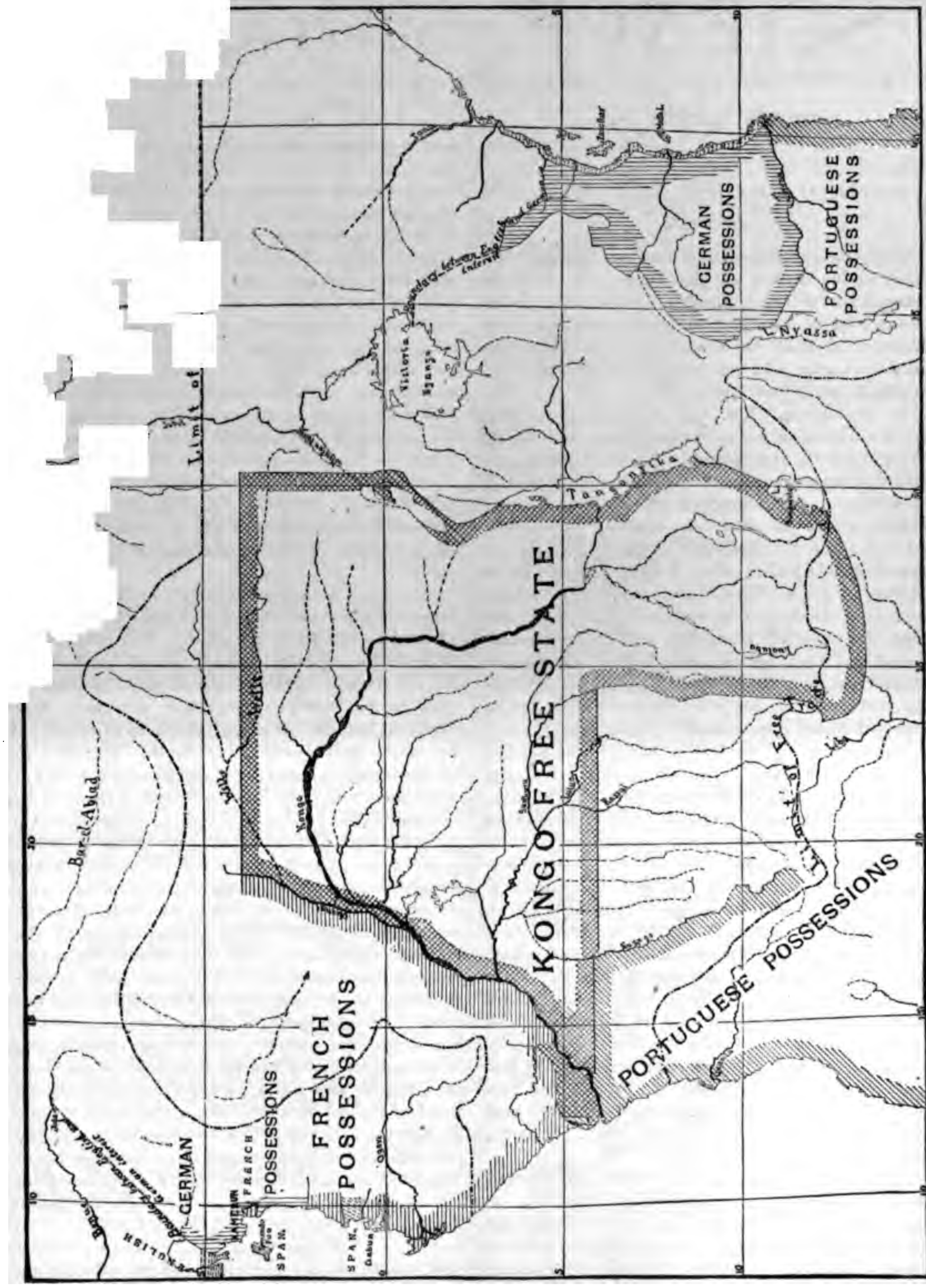
THE development of Central Africa is unparalleled in the history of discoveries. In 1877 its interior was totally unknown, and in 1884 we see the powers of Europe and the United States of America meeting in a conference to settle the affairs of this district, and acknowledging the young Kongo Free State.

In September, 1876, the Association internationale Africaine, for promoting the exploration of Central Africa and opening it to commerce, was founded under the auspices of Leopold II., king of Belgium. The original intention of this association was to establish stations in eastern Africa, and to use them as a basis for further explorations in Central Africa; but when the news of Stanley's discovery of the Kongo route, and his reports of the wealth of the interior, reached Europe, the base of operations was at once transferred to West Africa. The Comité d'études du Haut-Congo was founded at Brussels in November, 1878, and Stanley was appointed leader of its enterprises and expeditions.

Stanley reached the Kongo in 1879, and at once proceeded to establish the station of Vivi at the farthest point accessible to steamers. In January, 1880, this work was finished, and he started on his way up the river. The route from Vivi to Isangila is extremely difficult, the river being impassable on account of the numerous cataracts and rapids, and the land being intersected by deep gorges and valleys. Though a single traveller can accomplish the distance from Vivi to Isangila in six days, it took Stanley eleven months to get his stores and the sectional steamboat to that place. Steep declivities had to be graded and rocks to be blasted before he was able to carry his bulky luggage to Isangila, which place, was reached in December, 1880. From here he proceeded on the river to Manjanga, where the third station was established in May, 1881. In July, Stanley Pool was reached.

Meanwhile Savorgnan de Brazza had started from the Ogove, reached Stanley Pool, and induced Makoko, the chief of the Bateke, to accept the French protectorate. Though Stanley's intentions were thus forestalled by the enterprising French officer, he did not hesitate to establish his fourth station, Leopoldville, on the left bank of the Kongo, in order to save this section from the encroachment of the French. In December, 1881, the first steamer floated on the upper Kongo, and no further obstacle lay between Stanley Pool and Stanley Falls. In 1882, Stanley established the station of Mswata, opposite Brazza's purchases, and visited Lake Leopold. In order to prevent the French laying hold on the lower Kongo, he sent, in 1882 and 1883, several expeditions into the district north of the lower Kongo, where stations were established and land purchased. In 1883 the steamer proceeded to Stanley Falls, and the stations of Aruvimi and Stanley Falls were organized. Meanwhile the Comité d'études du Haut-Congo had assumed the name of the 'Association internationale du Congo,' and at the same time diplomatic negotiations began in order to obtain the recognition of its possessions by the European powers.

When the results of Stanley's activity became known, France and Portugal claimed large tracts of land in which the association had established its factories. Brazza claimed the left bank of the river from the mouth of the Kuango to Stanley Pool as belonging to Makoko's territory, and Portugal maintained its old claim to the coast as far north as latitude 5° 12′ south. The first to recognize the possessions of the Kongo association were the United States, which made a treaty with the association in April, 1887. As all commercial nations were interested in preventing a single power from getting control of the mouth of the Kongo and the rich countries of Central Africa, a conference was held in Berlin, the result of which was the recognition of the association as the 'Kongo Free State.' The negotiations for determining the boundaries of the state were not included in the programme of the conference, but were settled between the single states and the association. In February, 1885, a treaty with France was made at Paris, and the new state recognized by France. According to the stipulations of the treaty, France received the right bank of the Kongo from Stanley Pool to Manjanga, and the coast as far south as the mouth of the Chiloango. On the other hand, France relinquished its claim on the left bank of the Kongo. In the same month an understanding with Portugal was reached. Portugal received the south bank of the mouth of the Kongo, while the association




POLITICAL MAP OF CENTRAL AFRICA.

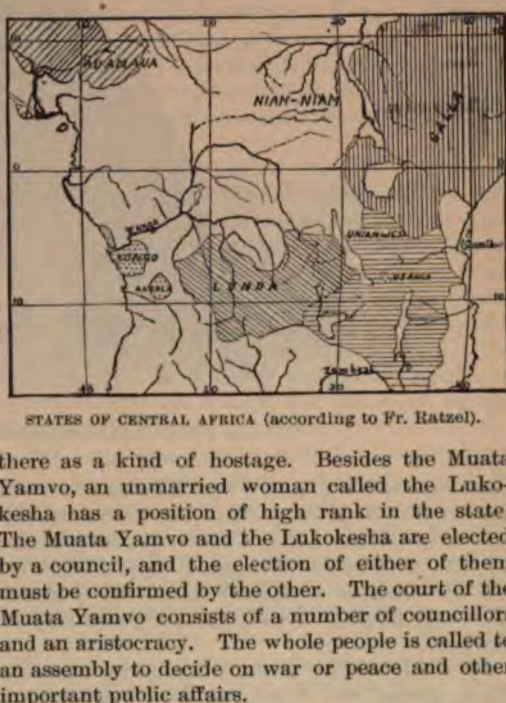
kept twenty-three miles of coast line on the north side of the Kongo.

At the conference the neutrality of the new state was guaranteed by the powers, the right of the single states to declare their colonies in Central Africa as neutral in case of a war was established, and free trade was declared in the Kongo basin and the adjoining territory from the Atlantic to the Pacific Ocean. Thus a great step forward in the development of Central Africa was made.

After the consolidation of the Kongo Free State, the European powers defined the much-disputed boundaries of their colonies by special treaties. The Portuguese territory north of the mouth of the Kongo was enlarged by a treaty between France and Portugal, May 15, 1886, and the northern boundary-line between French and German territory was fixed on Dec. 24, 1885. It was only a few weeks ago that the doubtful boundary-line on the east side of the French possessions, which was originally between the Likoma and the Obangi, was determined. The French territory extends now to the Obangi River. After Germany had taken possession of Kamerun, its claims came into conflict with those of England. In July and August last it was decided that a line from the great bend of the Calabar (Cross) River to Jola on the Benue should form the boundary between the two colonies. By this treaty the navigable Niger and Benue, which form the best route into the interior of West Africa, came into the possession of the English. In East Africa we find the possessions of the German East-African company, which are under the protectorate of Germany. A consequence of their purchases was the conference of England, Germany, and France in December, 1885, to determine the extent of the sultanate of Zanzibar. This question was settled by an exchange of notes on the 1st of November, 1886. The principal point of this agreement was the determination of a line separating future claims of both states. This line, which runs from the coast to the Victoria Nyanza, may be seen on the accompanying map. South of the German possessions, the Kongo Free State, and the French possessions, the African coasts belong to Portugal. The extent of its possessions towards the interior is not limited by a boundary-line acknowledged by the powers. Germany may raise a claim to the country south of the Kongo Free State, which is almost exclusively known through the explorations of German travellers.

Our notes on the political geography of Central Africa would be incomplete without a description of the states of the natives. Though a great part of Central Africa consists of small communities which do not form large states, we find several extensive empires, and several others have been destroyed since the Europeans invaded the country.

The peoples of Africa are frequently changing their habitations: large empires which are kept together by an energetic king, fall to pieces, and new ones take their place. Several large states, however, have existed for a long period. The most extensive of these is the empire of Muata Yamvo in Lunda. His residence is Mussumba. The government is feudal, there being a number of sub-chiefs who govern their own territories independently, but must send tribute to the Muata Yamvo, and have to follow him in case of war. So long as they conform to these obligations, the tributary states are independent, and the Muata Yamvo does not even interfere with the election of a successor in case one of the chiefs dies. Several relatives of these sub-chiefs, however, must live in the Muata Yamvo's residence, being kept



STATES OF CENTRAL AFRICA (according to Fr. Ratzel).

there as a kind of hostage. Besides the Muata Yamvo, an unmarried woman called the Lukokesha has a position of high rank in the state. The Muata Yamvo and the Lukokesha are elected by a council, and the election of either of them must be confirmed by the other. The court of the Muata Yamvo consists of a number of councillors and an aristocracy. The whole people is called to an assembly to decide on war or peace and other important public affairs.

Similar to the constitution of this state are those of most other African states, — despotism combined with an oligarchy. The empires of Kongo, Angola, and Loango, near the mouth of the Kongo, had a similar form of government; Angola and Loango were probably tributary to the king of Kongo.

The history of the Watuta in East Africa shows the origin of the states of that region, so far as

they are under the influence of Zulu-like tribes. Between Lake Nyassa and the Rovuma we find the Wahiyao, and on the plateaus west of the lake the Maviti, both warlike tribes closely related to the Matabele and Zulu. About 1840 the Watuta, who were a sub-tribe of the Maviti, separated from the main body on a predatory excursion which extended far north. They came to Urori, and after a war of five months with the strong and warlike tribe of that country, the Warori, being unable to subdue them, went north-west, and made war upon the inhabitants of Ujiji. Thence they turned north-east, fought with the Wahua and Warundi, and reached the Victoria Nyanza, where they remained for several years. They did not settle permanently, but returned to Usambara and Ugomba, where Mirambo founded the empire which has so frequently been described by European travellers. The development of this tribe to a powerful kingdom is characteristic of the unsteadiness of African states, the existence of which greatly depends on the personality of the chief.

In north-eastern Central Africa we find the Galla, Massai, and Wahuma. These are warlike tribes of herdsmen who have subdued the agricultural tribes which formerly possessed these districts. The Galla states are remarkable for the democratic character of their constitution. The chiefs are elected for eight years, and their power is limited by a council. They have no residence, but must continuously travel from one village of the tribe to the other to settle disputes and perform other duties belonging to the office.

AUDIENCE-HALL OF KING MTESA (according to Stanley).

The position of Europeans in the equatorial province has become very difficult through the hostility of the king of Uganda. While Mtesa, the last king, was friendly to the Europeans, his successor, Mwanga, has prevented them from passing his land, and the death of Bishop Hannington is due to him. At the present time he keeps Emin Pasha and his companions from Zanzibar, and his attitude compelled Stanley to take the Kongo route. A brief account of this region, which is so frequently mentioned in reports from Africa, may be of interest.

Formerly the large empire Kitara occupied the whole region between the Victoria Nyanza and Mvutan Nsige. In course of time it had the same fate as most other African states: it was divided into several smaller kingdoms, but every one of these is still powerful. Uganda, Unyoro, Karagwe, and Usinja are fragments of the old empire. The inhabitants of the land belong to two different races,—the agricultural Waganda, and the Wahuma, who are herdsmen. The royal family belongs to the Wahuma, who keep apart from the Waganda, have a language of their own, and live in separate villages. The Waganda are chocolate-colored, and have short woolly hair. The Wahuma are of a far lighter complexion. They have straight noses, thin lips, and large lustrous eyes. The traditions of the Wahuma refer to their immigration from the north, and their anthropological features agree with this statement, they being very similar to the Galla.

The power of Uganda is principally due to its military organization. The population consists

of four classes, — slaves, peasants, sub-chiefs, and chiefs. The peasants, who are the main body of the population, form the army. The sub-chiefs, who are elected from among the peasants, govern the provinces, and have the command of a certain number of soldiers. They are responsible to the Wakungu, the chiefs. These form a council, which in reality decides the affairs of the state. Every one of the chiefs must live three months out of every year at the residence of the king. Thus the state is thoroughly centralized, and the government has as much influence on the borders of the state as in the central provinces. If war is decided upon, the war-drums are beaten, and the whole army assembles before the royal palace. In time of peace the Waganda wear a toga made of bark; but in time of war they lay it aside, paint their faces white and red, and go into the battle naked, with the exception of a piece of cloth wound around the loins. Their weapons are beautiful spears with points more than a foot long, and oval shields of light wood covered with twigs and having a boss in the centre. Besides the spears, they use powerful bows, and poisoned arrows with formidable barbs. It is the privilege of the king to bear a copper lance. Armed with two of these lances, and wearing his shield, he stands before the entrance of his palace, surrounded by the chiefs, and gives his orders to the army. The palace is built of reeds and straw, and is about a hundred feet long, the roof resting on heavy timbers. The accompanying sketch shows the hall in which Mtesa gave his audiences, and where Stanley met him. A large fleet of canoes which the Waganda have on the Victoria Nyanza makes their army still more powerful. Some of their canoes carry as many as forty men, and it is said that from sixteen to twenty thousand men can be transported by the whole fleet.

This powerful nation is strong enough to shut off the region north of the Victoria Nyanza, and to prevent the passage of caravans through its territory. The distrust of the new king Mwanga hinders the work of European explorers and missionaries just as much as the friendliness of Mtesa had helped them. Though the kingdom has been for two generations in contact with Arabs, and later on with whites, it has retained its independence and power.

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## *PHYSICAL GEOGRAPHY OF CENTRAL AFRICA.*

THE map of Central Africa which accompanies the present number shows the river system of the Kongo, the head waters of the Nile, and East Africa. This part of the continent forms one of the large plateaus which give Africa its peculiar character. An immense highland occupies the continent south of a line drawn from Abyssinia to the Niger. Its rim is formed by mountain-ranges, which fall off in terraces toward the sea. A depression indicated by the valleys of the Kunene and Zambezi separates the plateau of South Africa from that of Central Africa. The eastern side of the latter consists of a number of high mountain-ranges and plateaus. The highlands of the Bangweolo and Nyassa lakes, which are from 4,000 to 5,000 feet high, extend to the caravan route leading through Unyamwesi. Its descent towards the Zambezi is very steep, while in the north-west it gradually falls off towards the plateau of the Kongo basin. Lake Bangweolo, which occupies the south-western portion of the highland, is 3,700 feet high. North of Unyamwesi the land rises to the mountainous district of the Victoria Nyanza and Muta Nsige, which attains a height of 11,000 feet in the mountains of Karagwe and Ruanda, west of the Victoria Nyanza. East of this region enormous volcanoes indicate the edge of the plateau, the Kilima Njaro rising to 19,000 feet, and the Kenia to 16,000 feet, in height. North-east of the Victoria Nyanza we find the highlands of Abyssinia.

This mountainous district contains the sources of all the rivers of Central Africa except the southern tributaries of the Kongo, which come from the swamps on the watershed between the Kongo and Zambezi. The latter river drains the southern slope of the plateau. Numerous small rivers, among which the Rovuma and Rufiji are the most important, descend from its eastern slope: the lofty mountains of Karagwe feed the sources of the Nile, and the Kongo has its origin on the western side of these highlands.

The large lakes which collect the head waters of all these rivers are characteristic of this part of Africa. Steep mountains surround the stormy Lake Nyassa, which occupies a long and deep valley on the southern side of the plateau. The large basin of the Victoria Nyanza is in part surrounded by low hills, and filled with many islands, but on its western side the steep mountains of Karagwe reach to its shore. This lake and the Mvutan Nsige are the collecting basins of the White Nile. From the Victoria Nyanza, which is 4,100 feet high, the Nile descends 1,350 feet, until it reaches the Mvutan Nsige, 2,750 feet above the level of the sea.

The Tanganyika is situated on the western slope of the highlands, and sends its water by the Lukuga into the Kongo. When the rivers belonging to the Kongo system have descended the terraces forming the eastern rim of the highland,

they flow slowly towards the west coast, unobstructed by rapids or cataracts until they reach the western rim of the plateau. Here the mighty Kongo and the smaller river rush down its steep side in roaring rapids and cataracts.

The character of this district depends to a great extent upon the meteorological phenomena, particularly on the amount of rainfall. North and south of the district included between latitudes 20° north and 20° south, the aridity of the climate, which is due to the trade-winds, produces the vast deserts and steppes of the Sahara and Kalahari. In the parts adjoining the equator we find rainy and dry seasons interchanging. On the west coast the climate is influenced by the prevailing south-westerly winds, which tend to lower the temperature, particularly as they blow from the cold Benguela current. The isothermal lines on the west coast approach the equator much nearer than do those on the east coast. There are two seasons, — the cool and foggy one, which has no thunder-storms; and the hot, rainy season. The dry season begins towards the end of May, and lasts, in the southern parts until August, in Loango until the middle of October. Farther north, at Gabun, the dry season lasts from June until the middle of September, but slight showers of rain occur in all months. During this season a whitish haze obscures the sun: early in the morning thick fogs cover the land, and the dew is very plentiful. The fog produces a drizzling rain, which is of great importance for the development of the vegetation. While the west coast south of the equator has little rain, the east coast, which is under the influence of the south-easterly trade-winds, is very damp. From May until October south-westerly winds prevail on this coast, while later on the trade-winds are blowing. The latter come from the warm Mozambique current, and are saturated with vapor, which is precipitated on the mountain-ranges of the east coast. Throughout the interior, summer rains prevail, but near the tropic of Capricorn the amount of rain is decreasing. Owing to the humidity of the climate, the rivers are very numerous, and carry great volumes of water. The watersheds of the whole district are very indistinct; the head waters of the Welle and Nile, and those of the Sankuru-Kasai and the Zambezi systems, being in close proximity, and not separated by elevations. The same is probably the case between the Welle and Shari, and until quite recently we did not know whether the Welle belonged to the Kongo or to the Tsade system. The swamps and lakes at the head of the Kasai probably form a bifurcation between that river and the Zambezi: according to Livingstone, the Dilolo Lake has a northern and a southern outlet.

The basin of Lake Bangweolo, and its outlet, the Luapula, may be considered the source of the Kongo, but the Lualaba is not inferior to it in size: and after both rivers have joined, above Nyangwe, the Kongo carries a great volume of water. Below Stanley Falls the Lubilash and Ubinji join it, and the river takes a westerly direction. It is a characteristic feature of the Kongo basin, west of longitude 25° east, that all rivers take a westerly direction. In the north we have the Welle-Makua, with its mighty tributaries the Werre and Mbomu. This river, which very probably empties into the Obangi, is one of the most important tributaries of the Kongo; but the Sankuru system, which drains the southern portion of the basin from longitude 15° to 25° east, is not inferior to it. During the early time of African travels, news reached us of the enormous Lake Sankuru, which at last proved to be the river system, which is now tolerably well known. The Sankuru has its source near the foot of the western slope of the East African highland, which is indicated by the numerous lakes of the upper Lualaba. As far as latitude 5° south it runs in a northerly direction, and then turns to the west. We are not sufficiently acquainted with the relief and geology of Central Africa to understand why the numerous rivers running south and north very close to each other suddenly take a westerly turn in this latitude. In the most central parts of the Kongo basin, which is situated between the Sankuru and Mbomu, this is the predominating direction. Among the tributaries of the Sankuru, the Lubilash, Kasai-Lulua, and Kuango, with its tributaries, carry the greatest volume of water. It seems that the north and south direction of the western part of the Kongo is caused by its approach to the western watershed. It is doubtful whether the Kadei and Nana, which are known by Flegel's inquiries in Adamaua, belong to the Kongo system. Here is the part of Africa which is least known. The coast tribes, for fear of losing the trade between the interior and the coast, prevent explorers entering the continent, and no traveller has reached that district either from the Tsade basin or from the Welle-Nile watershed. Besides this, the country east and west of the Kongo above Stanley Falls is unknown, and so is the territory north-east of the Victoria Nyanza.

The central depression between the plateaus of Central and North Africa is indicated by the Shari and Bar-el-Arab. The upper part of the former is still unknown, the south and north tributaries of the latter having been the field of Schweinfurth's, Junker's, Lupton's, and Emin's

explorations. On the west side we find high mountains in Adamaua, — which probably form the north-western corner of Central Africa, — and the volcanic Kamerun Mountains, which lie on one line with those of S. Thomé and Anno Bon.

## THE PEOPLE OF CENTRAL AFRICA.

THE northern boundary of the Bantu language, to which almost all tribes and nations of Central Africa belong, is a line running from Kamerun to the outlet of the Mvutan Nsige, including the Victoria Nyanza, thence turning south to the Kilima Njaro, and reaching the coast in about latitude 1° south. As compared with the large area occupied by dialects of this linguistic stock, the extent of other languages is very limited. Those of the negroes of the upper Nile, the Niam-Niam and Mangbatu, the Galla, and also those of the Benue and Central Sudan, do not belong to this stock; and it is impossible, with our present knowledge, to classify them properly.

The anthropologist finds even greater difficulty in classifying the races of Africa than the linguist, for the different types of African people are connected by numerous links. There are only a few places where a characteristic difference in appearance may be observed. As one instance we mention the remarkable light tribes of the Welle-Nile watershed, — the Niam-Niam and Mangbatu, and the scattered dwarfs of Central Africa. In comparing the ethnological peculiarities of the Niam-Niam with those of their neighbors, it strikes us that the Fan or Mpongwe, who invaded the Gabun region from the east, are very similar to them, and that their characteristic throwing-knife is found in southern Adamaua, and in slightly differing forms over the whole area north of the Kongo.

The dwarfish Mucassequere of the Kuando, south of Lunda, the Watwa of the southern Kongo basin, the Akka of the Welle, and several other West African tribes, are, in their anthropological appearance, very similar to the Bushmen of South Africa. Their height is about four and a half feet, they are of a yellowish complexion, and have woolly hair. The scattered occurrence of these tribes all over Central Africa makes it very probable that they inhabited the whole country before the invasion of the Bantu. Their languages are little known, but all of them seem to have adopted to a great extent that of the people with whom they live. They do not till the soil, but live almost exclusively as hunters.

The majority of the negroes live on the products of agriculture and stock-raising. There are no tribes without agriculture in Central Africa, except the dwarfish Watwa and Akka. Though their implements are very simple, they clear the dense woods, and fence in their fields. Hirse is the most important grain they grow. It is cultivated in all parts of Africa. Sorghum, manioc, and batatas are grown in the lower countries, maize and pulse on the highlands. In Uganda, bananas are the principal food. Stock-raising is the favorite occupation of many East African tribes. The herdsmen are frequently warlike nations who have subdued agricultural tribes. The Galla, Wahuma, and Watuta have founded empires of this kind. On the upper Nile the natives are engaged in both stock-raising and agriculture. Cattle, sheep, goats, dogs, and poultry are raised by these people.

The most remarkable industry of Africa is that of iron-working, which is known in all parts, the Bushmen alone being unacquainted with it when they became known to the Europeans. The Africans know how to obtain the iron from the ores, and manufacture beautiful implements of it. Besides iron, they manufacture copper implements and make copper and iron wire. The negroes do not know how to tan skins, but soften them by scraping and beating; neither do they practise the art of joining wood; while carving, plaiting, and weaving are highly developed.

The civilization of the negroes is not at all a low one. Their mode of life, their industry, and their political institutions are ample proof of this. Large empires founded by men excelling in intelligence and character, and extensive migrations of energetic nations, are characteristic of its history. The observations of all explorers show that arts and industry are far more developed in the interior than near the coast. Here, as everywhere else, the contact with nations of a higher civilization, the whites and Arabs, tends to destroy the native culture. Here the ruthless Arabian slave-hunters devastate regions which were flourishing before their arrival, and the final destiny of the Africans will depend to a great extent on the end of the final struggle between the whites and the Arabs.

## THE VEGETATION OF CENTRAL AFRICA.

THE peculiar character of the landscape of Central Africa is due to the great extent of its highlands and the frequently alternating woods and savannas. In the rainy districts of the west coast north of the Kongo, dense forests prevail, but farther south the vegetation is not so luxuriant. Here we find the baobab and the plants characteristic of the savannas of the central plateaus. But even in

the region of forests savannas are not wanting. Wherever the local climate is dryer, we find them, and the irregularity of the rainfall in this region may sometimes destroy woods. But besides this, the methods of agriculture applied by the natives are destructive to the forests, which are burnt or cut down. As the natives frequently remove their habitations from one place to another, large tracts of forest are annually destroyed.

The natives distinguish two forms of vegetation, — the campina and the forest. European travellers, particularly Pechuël-Loesche, who studied the vegetation of Central Africa, describes the character of the country as follows: In the campina, from one-fourth to one-half of the ground remains barren, while the rest is covered with grasses from three to six feet high. This is more particularly the case in the open campina,

VEGETATION OF CENTRAL AFRICA (according to O. Drude).

Dark lines, evergreen woods; light lines, woods with deciduous foliage and savannas; dots, tropical alpine flora.

which consists of Andropogon, Cymbopogon, and Ctenium. The period of vegetation is the season of thunder-storms, but before its end the seeds are ripe and the grasses begin to fade and dry up. There are only few shrubs mixed with these grasses, — Leguminosae, Compositae, Malvaceae, and Verbenaceae. Another characteristic form of vegetation is the bush, which is composed of evergreen thornless shrubs from twelve to fifteen feet high, with rigid leaves of a bluish or dark-green color. The bush is found on hills and slopes or on the plains in patches surrounded by the campina. Pechuël-Loesche distinguishes besides these the 'bush woods' and 'high woods.' The genera of these are identical, but the impression is very different according to the prevalence of high trees or of lower forms. In the 'high woods,' evergreen-trees prevail, the crowns of which are interwoven with climbers, while enormous trees with deciduous foliage tower above them. Though the multiplicity of form of the American tropical woods is not found here, they are described as not less impressive and grand than any other tropical forests.

The accompanying sketch-map shows the distribution of this kind of woods. They occupy almost the whole of the Kongo basin except the highlands of Karagwe and the region adjoining the watershed between the Kongo and Zambezi. On the east coast they are confined to a narrow belt adjoining the coast. The rest of the country except the summits of the highest mountains is occupied by savannas, and forests of trees with deciduous foliage. In East Africa the district between the Kilima Njaro and Lake Rikwa is almost exclusively occupied by savannas. The caravan routes from the east coast to the Tanganyika cross it in Ugogo.

The deserts and steppes north and south of the fertile belt of Central Africa do not belong to the district under consideration, but are confined to the area north of latitude 10° north, and south of latitude 15° south. On the west coast, however, vegetation becomes more scanty south of the Kongo, and in latitude 12° south some parts have the appearance of real steppes.

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THE latest additions to our knowledge of Central Africa are the exploration of the Mongalla and of the tributaries of the Obangi. We referred in *Science* of April 1 to Baert's exploration of the Mongalla. From the map in *Le mouvement géographique* of May 8, it appears that Baert reached latitude 2° 50′ north, and longitude 21° east. The mouth of the Mongalla on Baert's map is 35′ farther east than on Grenfell's map. The exploration of this river is very important, as it belongs to the unknown region of the watershed between the Welle and the Kongo. The only map of the tributaries of the Obangi yet published is that of the Ngiri, a small river draining the peninsula between the Kongo and the Obangi. In latitude 4° north the explorer of the Obangi, Captain van Gele reached the cataract of Zongo, which prevented further progress. This cataract is formed by a range of hills six or eight hundred feet high, through which the Obangi has cut its valley. The problem of the western tributaries is very essential to our knowledge of the orography of Africa, as the north-westerly rim of the large central plateau is still totally unknown.

—Dr. H. Labonne, who made some important explorations in Iceland last summer, left Cherbourg on April 15, to continue his studies on the geysers and glaciers of that island (*Gaz. géogr.*, April 21).

# SCIENCE.

FRIDAY, JUNE 3, 1887.

## COMMENT AND CRITICISM.

PROF. ARTHUR T. HADLEY'S thorough acquaintance with the railway problem puts it in his power to make a popular exposition of it that for clearness and conciseness is unrivalled. In *Harper's magazine* for June he outlines the progress of American railroad legislation. The Clinton league, the Granger movement, and the general railroad laws are touched upon, and their relation to each other shown. Then followed what may be called the period of state railroad commissions, that of Massachusetts being the example for nearly all the others. The state of affairs when the movement for a national railroad law became prominent, is characterized thus: "By the year 1880 it had become a well-established principle that it was impracticable to fix rates directly by law; that the important thing was to secure publicity and equality, and, above all, to have the means of holding the railroads responsible for what they did. On the other hand, the railroads had come to recognize, what ten years before they would have denied, that their business was not a purely private one; that they had public rights and responsibilities, and could not claim immunity from legislative control." Professor Hadley traces rapidly the genesis of the present Interstate commerce law, and in so far as it forbids preferential rates, provides for the publication of rates, and prohibits secret drawbacks, he unreservedly commends it. In its provisions as to local discrimination, however, and in its prohibition of pools, it is regarded as open to serious objection. But it is best regarded as a step to something wiser and better, as an experiment from whose failures a more perfect measure will be suggested. When this more perfect measure comes, it will doubtless, as Professor Hadley says, recognize the fact that railroad history plainly teaches that what we need is not so much a set of laws or regulations, but publicity and responsibility in railroad administration.

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THE TRUSTEES of the Elizabeth Thompson science fund have made the following grants, of which we have the pleasure of making the first public announcement: 1°. To the Natural history society of Montreal, $200, for the investigation of underground temperatures by a committee of that society; 2°. To Dr. T. Elster and H. Geitel, instructors at the gymnasium of Wolfenbüttel in Germany, $210, for researches on the electrization of gases by glowing bodies; 3°. To Prof. E. D. Cope of Philadelphia, $500, for researches on American fossil vertebrates, the sum to be expended to secure the services of a skilled preparateur to assist in working out the material already accumulated for the continuation of Professor Cope's great work; 4°. To W. H. Perkin, jun., of Manchester, England, privat-docent at the University of Munich, Germany, $250, for investigations on the synthesis of urea from its decomposition products; 5°. To Edward E. Prince of St. Andrews, Scotland, $125, for the investigation of the development and morphology of the limbs of teleosts. It may be worth while to add, that these appropriations indicate that the trustees are inclined to make several appropriations of moderate amount rather than a single large one. It will be noted that no grant over $500 has been made. This point may be of interest to intending future applicants.

## SEA-SICKNESS.

THE sensation of sea-sickness is one which has in one form or another been experienced by most persons, if not on the sea itself, at least while riding backward or in swinging. It is the dread of this rather than the fear of accident which deters many from undertaking a European tour, and it is therefore a question of great interest whether or not this experience may be avoided, and thus the principal obstacle to an ocean voyage be removed.

Although in most instances sea-sickness is but temporary, disappearing as soon as the affected individual places his foot on shore, still this is not always the case. In rare instances it has been the cause of death, and even when this has not been the case, the individual has been permanently affected. In many cases what is usually but an inconvenience and a disagreeable sensation becomes a disease which demands medical treatment on account of the violence of its symptoms. It is for

these reasons that physicians have made a study of sea-sickness, and have in various publications given the results of their investigations to the world.

In Quain's 'Dictionary of medicine' sea-sickness is defined as a peculiar functional disturbance of the nervous system, produced by shock, resulting from the motion of a ship. The most prominent symptoms are a state of general depression, giddiness, vomiting, and derangement of the bowels and of the urinary secretion. Dr. B. W. Richardson, in his 'Field of disease,' says that the phenomena of sea-sickness may be placed under the same head, in regard to cause, as concussions experienced by iron-plate workers who are employed in riveting, or by travellers on railroads. In sea-sickness the effect of the motion of the vessel is to produce a series of shocks to the ganglionic or organic as well as to the cerebrospinal system. In some persons the organic nervous system is chiefly affected, and they suffer from vomiting and loss of appetite, and may remain prostrated for many weeks, and in one instance the sickness was never entirely recovered from during a comparatively long life; in others the shock tells most upon the brain and spinal cord. Such cases are less troubled with vomiting, but are oppressed with headache, giddiness, and inability to stand upright or move with steadiness. After they have completed the voyage, these persons suffer still from unsteadiness in walking, feeling, as they express it, the movements of the vessel. A repeated series of concussions, as it were, affected the brain so as to leave an impression of a wave-like motion, which does not subside until after a considerable length of time.

Various other theories have been held in regard to the causation of sea-sickness. Wollaston, who wrote on the subject in 1810, considered it due to sanguine congestion of the brain brought on by a deranged centre of gravity during the pitching forward of the vessel; Barru believed it to be owing to irritation of the optic nerves caused by the apparent vacillation of every thing around the vessel; Pellarin accounted for it by sanguine depletion in the brain caused by a centrifugal force called into action within the blood-vessels in consequence of the oscillation of the ship. In more ancient times Plutarch treated of the subject, and attributed sea-sickness to the smell of the sea and the fears of the patient.

Among those who have written treatises on the subject, we mention Dr. John Chapman as one whose treatment has been measurably successful. This writer gives it as his opinion that the main proximate cause of the affection is an undue amount of blood in the spinal nervous centres, and especially in those parts of them directly related to the stomach and the muscles concerned in vomiting. The result of this hyperaemia is that the nerves emanating from the affected nervous centres partake of the undue activity of the centres themselves, and convey to their ultimate distributions an excessive amount of nervous impulses, which have the effect of disturbing the ordinary action of the organs supplied.

It will be seen from this brief consideration that there are many and various theories in regard to the causation of sea-sickness, and the number might be increased did space permit. As would naturally be expected, the methods of treatment are also various. Dr. Chapman recommended the application of ice, contained in rubber bags, to the spine, with the idea of overcoming the hyperaemic condition of the spinal cord, which he believed to be the cause of the symptoms. Some twenty years ago this plan of treatment was adopted by a considerable number of individuals, and remarkably favorable results were reported. Travellers crossing the Channel and making sea-voyages, who had previously suffered severely from sea-sickness, were by means of the ice-bag enabled to make their journeys with comfort, and freedom from sickness. In recent years we have heard but little of the ice-bags. Whether this is to be accounted for on the ground that on a fuller trial they failed to accomplish all that was claimed and expected, or whether the difficulty connected with their use was too great for them ever to come into general use, we do not know. In a recent letter to a daily paper a correspondent states that he has made twenty-six trips, or fifty-two tours, across the Atlantic, and has in every instance, except the last, suffered very much from sea-sickness. On this last trip he had with him a rubber bag, twelve inches long and four inches wide, the mouth of which was closed by an iron clamp. This he filled with small pieces of ice and applied to the spine at the base of the brain for half to three-quarters of an hour every morning. It had a most soothing effect, and he enjoyed every hour and every meal.

In a recent number of the *Boston medical and surgical journal* is a letter from William James of Harvard college, in which he says that whilst studying the feeling of dizziness, he was led to discover the singular immunity from it which deaf-mutes, as a class, possess, and he attributes this to the destruction either of the auditory nerves or of their labyrinthian termination. He found also in deaf-mutes what seemed signs of a possible immunity from sea-sickness, and ventured the suggestion that the semicircular canals

were probably the starting-point of that affection also, and that its symptoms in an ordinary sufferer might be alleviated by blistering or otherwise counter-irritating the skin around the ears. Later, in crossing the English Channel, he thought he prevented an attack of sea-sickness in himself by rubbing the mastoid processes with his fingers. He has since been unable to get any one to try the plan. He refers to an account of an accident which happened to the editor of the *Gulf review*, of Florida, as confirmatory of his views of the cause of sea-sickness. In this accident the editor received a blow on the mastoid process just behind the right ear, crushing the outer table of the skull, and destroying the delicate nervous portion of the internal ear, including the semicircular canals. The immediate consequences of the injury were, first, the most distressing nausea of a character identical with sea-sickness, which lasted, with intervals of ease, for two or three days; and, secondly, complete destruction of the function of the ear, being deaf in that ear ever after. Shortly after convalescence, the writer made a voyage to Cuba and back in rough weather, exposed to a very rough sea for six days each way, and, although previously very susceptible, he found himself proof against sea-sickness; and this immunity has continued ever since, now nearly twenty-eight years. Dr. James requests that travellers will bear his suggestion in mind, and report to him the result, whether successful or failures.

Dr. Fordyce Barker, an eminent physician of New York, and a traveller by ocean of great experience, has also suggested a method for the treatment of sea-sickness. He recommends that in making a short passage over rough water a hearty meal should be eaten not more than two or three hours before sailing, and that the individual should, if possible, keep in the centre of the vessel, and lie down before starting, and that he should avoid disagreeable sights and smells. In making ocean voyages, he should select his berth with these same objects in view, and should remain in bed for one or two days, and eat regularly and heartily. He should take a cup of coffee or tea each morning before rising, and should keep the bowels regulated. If diarrhoea sets in, it should be controlled by the remedies usually given for cholera-morbus. If the weather becomes rough, he should go to bed before becoming sick.

It may be of interest to note that a large number of remedies has been recommended from time to time, by physicians and others, for sea-sickness. Among them are the bromides of potassium and sodium, hydrate of chloral, opium, chloroform, hydrocyanic acid, alcohol, nitrite of amyl, cocaine, strong coffee, Hoffman's anodyne, bismuth, bicarbonate of soda, and nitroglycerine; for external application, ice, stimulating liniments of belladonna, chloroform and camphor, and hot bottles to the feet. It is a safe principle in medicine that when, for any given disease, a large number of remedies is recommended, the specific remedy, or that which will cure all the cases of that disease, or the most of them, has not yet been discovered. The writer in Quain's dictionary says, on the subject of treatment, it may be premised that there is no known means of preventing sea-sickness in those susceptible of it. We should be glad to have the recommendation of Dr. James carried out, and to receive reports from those who, during the coming summer, may try his plan.

## *THE MEETING OF THE ECONOMIC AND HISTORICAL ASSOCIATIONS.*

ON Tuesday morning, May 24, the Historical association listened to papers on 'A study in Swiss history,' by J. M. Vincent of Johns Hopkins university; 'The Spaniard in New Mexico,' by Gen. W. W. H. Davis; and 'The historic name of our country,' by Prof. Moses Coit Tyler of Cornell. The Economic association first heard the report of its committee on the 'Condition and organization of retail trade,' which was the subject of some discussion, and then Prof. Henry C. Adams read a report on 'Municipal public works.' The replies to the committee's circulars to gas companies were interesting.

Circulars were sent to 971 gas companies in the United States; and of these, 675 sent replies to various questions relative to price of gas per thousand cubic feet. The prices ranged all the way from 75 cents to \$20 a thousand feet. All over \$6 were considered so abnormal as to be put out of consideration. It was found that the average price of the coal-gas companies was \$1.73, that of water-gas \$1.85, and the total average \$1.75, per thousand feet. It was remarked, that, although the average cost of producing water-gas was not as great as that of the coal-gas, the price of the former was greater. This is due to the fact that popular ideas of relative danger and other circumstances did not warrant the production of the water-gas on so large a scale as the coal-gas companies are warranted in producing it.

The afternoon session was a joint one of both associations, and was held at Sander's theatre, Harvard university. Three papers were presented. The first, by Prof. E. J. James of Philadelphia, was on 'Our legal tender decisions,' and

was a defence of the last decision of the supreme court against the criticism of George Bancroft. Dr. A. B. Hart of Harvard read an amusing 'Biography of a river and harbor bill,' in which he traced the history of this bill for 1887 as an illustration of congressional methods and financial legislation. The paper by Col. Carroll D. Wright, on the 'Study of statistics in colleges,' was by many considered the most valuable of the meeting, and we are glad to learn that it will shortly appear in pamphlet form. Colonel Wright showed what Europe was doing in statistical studies, and paid a deserved compliment to Prof. Richmond M. Smith of Columbia for his work in this field. He pointed out the difficulty of applying statistics properly, and insisted on the necessity for trained statisticians. He would arrange the teaching of statistical science in three grand divisions: 1. The basis of statistical science, or, as it has been generally termed in college-work, the theory of statistics; 2. The practice of statistics, which involves the preparation of inquiries, the collection and examination of the information sought, and the tabulation and presentation of results; 3. The analytical treatment of the results secured. He remarked that our census could be more scientifically taken, could more of the subordinate workers be men who had had a statistical training.

The active work of both associations closed Tuesday evening. The closing papers before the Historical society were, 'The government of London,' by Prof. Arthur M. Wheeler of Yale university; 'Religious liberty in Virginia, and Patrick Henry,' by Charles J. Stillé, LL.D., of Philadelphia; 'The American church in history,' by Dr. Philip Schaff of Union theological seminary, New York; 'Brief report on historical studies in Canada,' by George Stewart, jun., president of the Historical society, Quebec. The following committee was appointed to urge congress to establish a national commission to collect and care for the manuscripts and documents relating to U. S. history: Justin Winsor, George F. Hoar, John Jay, Andrew D. White, Rutherford B. Hayes, Ainsworth R. Spofford, and President Dwight of Yale. The officers elected for the ensuing year were as follows: president, William F. Poole, Chicago public library; vice-presidents, President Charles K. Adams of Cornell, John Jay of New York; secretary, Prof. H. B. Adams, Johns Hopkins university; treasurer, Clarence W. Bowen, New York City; executive committee, Rutherford B. Hayes of Ohio, Prof. John W. Burgess of Columbia, Prof. Arthur M. Wheeler of Yale, and William Wirt Henry of Richmond.

The principal paper at the closing session of the Economic association was by Prof. Frank J. Goodnow of Columbia, and was on the 'Administrative aspect of municipal franchises and finance in Europe and America.' The paper was an able study in comparative administrative law, and commanded the closest attention. It was discussed by Professor Johnston of Princeton, Professor James of Philadelphia, Mr. Giddings of Springfield, Mass., and others. Professor Ely read his report, which spoke most encouragingly of the society's prospects. The total membership is now over three hundred, and much interest is shown in the work, even in England.

Pres. Francis A. Walker of Boston, and Dr. Nicholas Murray Butler of Columbia, were appointed a special committee to report on the economic effects of industrial and technical education in the United States. The officers elected were as follows: president, Francis A. Walker; vice-presidents, Prof. Henry C. Adams, Prof. E. J. James, Prof. J. B. Clark; secretary, Prof. R. T. Ely; treasurer, Dr. E. R. A. Seligman. On Wednesday, the 25th, both associations made an excursion to Plymouth, and dined together at the Samoset house. The meeting was a most successful one, and the officers of the Institute of technology and of Harvard university did every thing in their power to render it enjoyable. It is proposed to hold the next meeting at Columbus, O., in September, 1888.

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## NEW ZEALAND LETTER.

THAT portion of the year which extends from May to October inclusive, is the busiest in this part of the world for politicians, university men, and members of scientific and literary societies.

In matters political, the question upon which public opinion in the colony is being most exercised, and around which parties are gradually crystallizing, is that of free trade *v.* protection. This also is the question which will probably prove the one of chief interest outside our own borders; and those who have borne their part in the long-continued struggle still being fought out in the states, will naturally feel more or less interest as they see these small but growing Australasian communities entering upon the same struggle. We have two noted examples before us in Victoria and New South Wales: the latter — free trade to the backbone — is apparently far outstripping its rivals in the race for wealth and progress. One aspect of the question, on which, however, it is pre-eminently difficult to frame an opinion, is as to which of the two communities enjoys the greatest amount of social peace and harmony, and in which is there the least amount

of misery arising out of their commercial relations. In this colony the majority of the manufacturers are already heavily protected by the customs duties — amounting in most cases to about sixteen per cent *ad valorem* — which it has been found necessary to levy for revenue purposes. Without such duties, many of the manufactures now established, notably those of cloth, blankets, woodware, etc., would be quite unable to exist. But those directly interested are by no means satisfied with the measure of protection already enjoyed, and are clamoring for more. The coming parliamentary session will probably be marked by a determined attempt to commit New Zealand to a protectionist policy.

The university colleges, of which three are now well established at Dunedin, Christchurch, and Auckland, with a fourth about to be started in Wellington, open their sessions for the year either this or next month. The Canterbury (Christchurch) and Auckland colleges hold two sessions of a little over three months each, with a break of a month between; while the University of Otago (Dunedin) has only one six-months' session, the classes adjourning for a fortnight's necessary rest in the middle. The idea in the latter, which is founded on the lines of the Scotch universities, was to enable the students to teach six months, and study six months. It is found that but few can avail themselves of this plan, and an attempt has recently been made to assimilate all the colleges to one plan; but for the present this has not met with success. The present premier, who is also minister of education, Sir Robert Stout, is endeavoring to specialize the work of the different colleges, in order to prevent too much rivalry and clashing of interests. Thus Otago already possesses a complete faculty of medicine with a full staff of professors and lecturers, and is authorized to grant degrees of M.B. and C.M. Last session there were medical students, and the number is increasing yearly. As the university of Edinburgh accepts work done in Dunedin as equivalent to that done by their own extra-mural teachers, it has hitherto been usual for the Otago students to take two or three years' study here, and then go to Edinburgh for their degree. Now, however, that the medical staff is complete, the number who graduate here will steadily increase.

Otago also possesses a school of mines in connection with her university; but this Sir R. Stout wishes to transfer to Christchurch, which already has in Sir Julius von Haast of the Canterbury museum, and Prof. F. W. Hutton, two men widely known for their geological researches.

The University of New Zealand, to which these colleges and a few of the larger secondary schools are affiliated, is a somewhat anomalous body. It consists of a senate and convocation, endowed with powers to grant degrees and to manage their own internal affairs, and supported by a small annual grant from the government. But like the University of London, whose example it intended to follow, it has no teaching staff in direct connection with it, and, to suit the geographical conditions of the country, it is peripatetic, holding its annual session in one or other of the larger towns. Its headquarters for the time being will always be where its chancellor resides; and as that honorable position is held at present by Dr. Hector, the chief scientific adviser of the government, the seat of administration is in Wellington.

A vigorous effort has been put forth for the last two years to establish schools of mines in the principal mining-centres of the colony. Dr. J. G. Black, professor of chemistry in Otago university, is the leading spirit in this movement, which has been warmly supported by the government. Whether the attempt to popularize chemistry is altogether a wise one, in the way at any rate in which it has been done here, is a matter of opinion. Mere test-tubing, taught in a dozen lessons, will not convert a rough gold-miner into an expert mineralogist, yet this is too much the kind of thing which has been resorted to. In every mining-centre, large or small, testing-classes have been started, where hundreds of novices, destitute of the most elementary knowledge of chemical principles, are introduced to the art of the qualitative analysis of minerals. Whatever they learn, they don't get any scientific training. It is impossible, however, to deny that Dr. Black has exhibited immense enthusiasm and zeal in carrying out his plans; and if these result, as he hopes they will, in the ultimate establishment of properly equipped schools of mining, he will have achieved a noble work, in the success of which the earlier crude efforts will be forgotten.

There is immense room for improvement in methods of alluvial mining, and especially in the utilization of the fine gold of which so much is now lost. In the Laurence district of Otago, the famous Blue Spur cement, after being crushed and treated for gold, has been repeatedly washed; yet at the present day a considerable number of Chinese miners are still engaged turning it over and washing it, probably for the tenth time, and they make from eight to ten shillings a day, or more, at it.

An attempt to open up the West Coast sounds country this last summer has not been very successful. The dense forest vegetation and the generally inaccessible nature of the country have proved such difficulties that prospecting has been

greatly delayed. Until tracks fit for a horse to travel in have been cut through the bush, it will not be possible to open up this district, which in parts teems with mineral wealth. The excessive rainfall — which, however, has never been measured — makes life in that district rather miserable; while the hordes of bloodthirsty sandflies, which occur everywhere in the open country, tend at times to make it unendurable. G. M. T.

Dunedin, N.Z., April 20.

## HEALTH MATTERS.

### Ladies' health protective association.

THE Ladies' health protective association of New York, which was incorporated in 1884, has published its report for the years 1885 and 1886. The particular business and object of this society are stated in the certificate of incorporation to be the protection of the health of the people of the city of New York by taking such action from time to time as may secure the enforcement of existing sanitary laws and regulations, by calling the attention of the proper authorities to any violations thereof, and to procure the amendment of said laws and regulations when they shall be found inefficient for the prevention of acts injurious to the public health. Any lady residing in the city may become a member of the association, and any gentleman may be admitted as an advisory member. One of the first nuisances attacked by the association was the manure-yard of Michael Kane at the foot of East 46th Street, in which large quantities of stable-manure were accumulated. Kane had been indicted four years before, but the nuisance still continued. Another complaint was made to the grand jury, and three ladies of the association were summoned before that body to testify. He was again indicted, and subsequently tried and convicted, and the manure entirely removed. During one of the visits of a committee, its members were attacked by a mob, which necessitated police escort in their future investigations. The attention of the association was next directed to the slaughter-houses of the city. In the annual report it is stated that three interviews were had with the board of health to obtain the co-operation of that body in an effort to remove the slaughter-houses from the city limits, or else to compel them to conform to proper sanitary regulations. Meeting with no encouragement, a bill was prepared and submitted to the legislature, providing for better regulations for the slaughter-houses. A public meeting was held to sustain this movement, at which Hon. Noah Davis, chief justice of the supreme court, presided. The bill did not pass the legislature, but the efforts put forth by the association aroused the public attention and interest. In the following year the nuisance from accumulated manure again demanded interference. A bill was presented to the legislature, establishing a permanent dumping-ground between 95th and 97th streets and 1st Avenue and East River. Through the efforts of this association, the measure was defeated. The report states that the removal of stable-refuse, and its transportation through the city, are still subjects of annoyance and complaint, and that the ordinances limiting the hours and the manner of removal are continually disregarded. Efforts are being made to persuade railroad companies and others to bale the manure, and thus diminish the nuisance. The association has been informed by one of the large slaughterers of the city that he will build an *abattoir* which will be a model in every respect, and this is looked forward to as one method of lessening the nuisances connected with this business. The gas-works, and a section of the city known as 'Little Italy' between 5th and Madison avenues, east of Central park, have also engaged the attention of the members of the association. Examinations have also been made of numerous tenement-houses and schools. The association has demonstrated that a few determined persons, actuated by the public good, can accomplish a great deal in the way of reform, and we wish the association success in its work.

TYPHOID BACILLUS. — Dr. Sternberg has recently conducted some experiments as to the thermal death-point of the bacillus of typhoid-fever. A fresh culture of the organism was introduced into capillary glass tubes, which, after being hermetically sealed, were placed in a vessel containing water, and exposed to a constant temperature for ten minutes. At the end of this time the contents of these tubes are introduced into sterile flesh-peptone-gelatine contained in test-tubes. These are in turn placed in an incubating-oven, and exposed to a temperature of 20° to 22° C. If at the end of a week the organism has not developed, it may be taken for granted that it has been destroyed by the heat. After eight experiments of this kind, it was found that in no instance did the bacillus develop after it had been exposed to a temperature of 56° C., while in one experiment growth occurred after exposure to 55°. The thermal death-point of this bacillus may be safely placed at 56° C. (132.8° F.).

YELLOW-FEVER INOCULATION. — In 1885 and 1886, 6,524 persons submitted themselves to protective vaccination against yellow-fever in Rio

Janeiro. During these two years, 1,675 persons died from that disease; and of that number, 1,667 were unvaccinated, eight only of those who had received the treatment having died. This statement was made by Freire and others to the Academy of science. These gentlemen state, that, taking as the basis of their calculation the population exposed to the contagion, the percentage of deaths for the whole number was one per cent, whereas for those who had been subjected to preventive inoculations it was only one per thousand.

A THREE-YEAR TRANCE. — In the *Revue d'hypnotisme* is reported the case of a young lady who has been in an uninterrupted trance for nearly four years. In 1883 she received a fright, and shortly after had convulsions, from which she passed into a profound sleep which has continued to the present time. She takes food in small quantities. Dr. Bérillon, who reports the case, has, as the result of his examination, found the limbs wasted, and the fat of the body to have disappeared. Anaesthesia is complete. The pulse is very weak, and beats one hundred to the minute. The face is pale, waxy, and expressionless. She is totally unconscious, and cannot be aroused.

PURIFICATION OF SEWAGE. — L. P. Kinnicutt, professor of applied chemistry at the Worcester free institute, has recently given his opinion as to purification of the sewage of that city by means of chemical precipitation. In his report to the city engineer, he discusses the three general methods used for the purification of sewage, — irrigation, intermittent filtration, and chemical precipitation. That sewage can be purified in England by the system of broad irrigation, when the system is carefully carried out, there is no question. The amount of land required, however, is very great, probably an acre for every fifty persons. This, together with the cost of properly preparing the land, conducting the sewage thereto, and carrying the effluent away, makes the system a most costly one for a city of any size. Purification of sewage by means of intermittent filtration is an attempt to reduce the amount of land by applying the sewage intermittently, the amount of land being, as given by the most careful authorities, one acre to five hundred persons. The cost of preparing the land for this purpose is very great, as it must be deeply under-drained. The land, when used, is not well fitted for the production of crops, and the decomposition of the organic matter contained in the sewage depends almost entirely on the oxygen contained in the soil. The third method, chemical precipitation, consists in adding certain chemicals to the sewage, which precipitates practically all the suspended matter, and which could undoubtedly be carried to a point where most of the offensive matter in solution was destroyed. The effluent obtained by this process can either be carried directly into a running stream, or first filtered through a small area of land. The recommendation of Professor Kinnicutt in reference to the best method for the purification of the sewage of Worcester is that chemical precipitation be adopted, with the addition of a small area of land, for possible use in very hot, dry weather; and, for every million gallons of sewage, the addition of about 900 pounds of quicklime for the neutralization of free acid, and 2,150 pounds in the form of milk of lime, or 1,000 pounds in the form of lime-water, for the precipitation process proper.

## EXPLORATION AND TRAVEL.

### *Africa.*

THE journal of Bishop Hannington, who was murdered in Uganda, contains some interesting notes on Masai Land, according to *Petermann's Mitteilungen* for May. His travels between the Victoria Nyanza and the Nile are important, as he was the first white man to visit that part of the country.

Count Teleki has organized an expedition to Central Africa, which left Zanzibar on Jan. 24, under the command of Lieutenant von Höhnel. The object of the expedition is the exploration of the Kilima Njaro.

Extracts from letters of H. M. Stanley, dated from the Kongo on March 20 and 21, are published in the London *Times*. The expedition arrived at Banana Point on March 18, after a pleasant and satisfactory voyage. Stanley chartered three small steamers belonging to the trading companies of the lower Kongo, and on March 20 and 21 the whole expedition was conveyed to Matadi. The expedition appears to be in a very satisfactory condition. A serious disturbance between the Zanzibari and Tippo-Tip's men on the one side, and the Sudanese on the other, was quickly suppressed; and Stanley says that later on perfect peace prevailed among the different elements composing the expedition. The news he received at Bomo from the committee in charge of the administration of the Kongo Free State was very discouraging. He was informed that a serious famine existed as far as Stanley Pool, and that the steamer Stanley is at present hauled up for repairs. Besides this, the Baptist mission refused to lend its steamer Peace to the expedition. Thus Stanley encounters numerous obstacles; but we may expect, nevertheless, to hear soon of his arrival at Stanley Pool.

As the Stanley relief expedition makes it unnecessary to send another expedition to the relief of Captain Casati, the Milan Società d'esplorazione commerciale in Africa has changed its plans, and has sent two of Tippo-Tip's men to Unyoro, bearing letters of credit for Casati to the missionary and trading stations on the route. Thus Casati will be enabled to return from Unyoro to Zanzibar, and it is probable that in this way Emin Bey will be informed of Stanley's attempt to reach him.

It is stated in *Petermann's Mitteilungen* for May that the German Reichstag has appropriated 150,000 marks (about $36,000) for the continuation of explorations in Africa. While former appropriations were used for the expeditions of the German-African society, the government has resolved to use the present appropriation for the exploration of the German possessions in Africa. Lieut. R. Kund, the explorer of the Lukenye, will be sent to Kamerun, to penetrate from that point into the interior, which, on account of the hostility of the natives, has been hitherto inaccessible.

A. von Dankelmann has reduced the barometrical observations of R. Kund, and compared them with those obtained from the observations of von François, Dr. Büttner, and von Mechow. As stated in *Petermann's Mitteilungen*, he considers the height of Stanley Pool (900 feet) and of San Salvador (1,800 feet) reliable. The rivers Kuango, Kuilu, Sankuru, and Lukenye are from 1,050 to 1,300 feet above sea-level, the western rivers being the more elevated. This fact shows that these rivers run through an extensive plain, into which they have cut their beds.

### *New Guinea.*

We learn from the Proceedings of the Royal geographical society for May that the government of Victoria is preparing to send out a well-equipped expedition to explore the Owen Stanley Mountains from Port Moresby, and has offered the leadership to the man of all others best able to carry so difficult an undertaking to a successful issue; namely, the Rev. J. Chalmers. A grant of ten thousand dollars has been made towards the cost of the expedition, and further contributions are expected.

### *America.*

Chaffanjon writes from Ciudad Bolivar to the Geographical society of Paris (*Compt. rend.*, No. 9) that the success of his expedition to the sources of the Orinoco was complete. His companions, Indians from the Maquiritares and Bares tribes, were so much afraid of the Guaharibas, who inhabit the region about the head waters of the Orinoco, that he had the greatest difficulty in inducing them to follow him. He explored the mountains of that region, and determined the positions of numerous places by astronomical observations. He is going to visit the sources of the Essequibo before returning to France.

The expedition of Dr. K. von den Steinen, before leaving the coast of Brazil, made some anthropological and ethnological researches among the Sambuquis in the province of Santa Catharina (*Gazette géogr.*, May 12). The company intended to start for the head waters of the Xingu on the 2d of May. Although ethnological studies are the main objects of the expedition, Messrs. Gervaiso Ninus Piris and Moreira de Silva have accompanied it for the purpose of making geological observations.

## *NOTES AND NEWS.*

THE vessels of the U. S. coast survey are now located as follows: the Bache left Key West May 24, and arrived at New York last Tuesday, where she will fit out for work in Vineyard Sound; the Gedney left New York May 30 for work on the coast of Maine; the Olympia is now at work on the coast of Washington Territory; the Endeavor is now on the Louisiana coast, but will close its work this week and proceed to New York. Mr. F. W. Perkins, who has been on the steamer Hitchcock on the coast of Louisiana, has dismissed his party, and will be in Washington until June 15; Mr. J. H. Turner has been ordered to Salt Lake City, and will continue the work on the triangulation of the 39th parallel; Captain Boutelle has gone to St. Paul, Minn., to organize a party under the direction of Professor Hoag of the University of Minnesota, for making a triangulation survey of the state The work will begin between St. Paul and Fort Snelling.

— The American fisheries society began its annual session in Washington last Tuesday. There was a large attendance of the members. The following are the officers of the society: president, Dr. W. M. Hudson, Hartford, Conn.; vice-president, W. L. May, Fremont, Neb.; treasurer, E. G. Blackford, Brooklyn, N.Y.; recording secretary, Fred Mather, Cold Spring Harbor, N.Y.; corresponding secretary, W. A. Butler, jun., Detroit, Mich. Prof. W. O. Atwater of the Wesleyan university presented a paper on "The chemical changes produced in oysters in floating, and their effect upon their nutritive value." Mr. K. Ito, superintendent of the fisheries of northern Japan, spoke upon the methods of fishing in Japan as compared with American methods.

—The fifteenth annual session of the American society of mechanical engineers began in Washington on Tuesday, May 31, over seven hundred

members being present. The secretary, Mr. F. R. Hutton, presented the report of the council, which stated that through Mr. Stephen W. Baldwin the society had gained possession of much of the expert apparatus belonging to the late Mr. John C. Hoadley of Boston.

— The second field-meeting of the Indiana academy of science was held at Waveland, Montgomery county, Ind., May 19 and 20. The first day was devoted to the exploration of the rugged sides of Sugar Creek in the vicinity of 'Shades of Death.' In the evening, Dr. T. C. Mendenhall, president of Rose polytechnic institute, delivered an address on 'Weather-predictions.' The second day was devoted to an excursion to Pine Hills, a picturesque region along Sugar Creek. The evening exercises consisted of a general discussion of the natural history of the localities visited. Over thirty members were present. The meeting was in every way a success. The committees which made the arrangements are deserving of much credit for the way in which their arrangements were carried out. The next meeting will be held at Indianapolis late in December.

— The American institute of electrical engineers was organized at New York City on May 13, 1884. It was the intention of its founders to establish a national organization of high character, which should be in every respect worthy of the support of American electrical engineers. In order to enhance its usefulness to the electrical fraternity, a determined effort was made at the annual and general meetings just past, to purchase a building in New York City, which is to be, what the title of the society implies, the 'American institute of electrical engineers.' This movement has been under consideration for three years past, a standing committee having been previously appointed for the work during the first term of Pres. Norvin Green. Among the important features of the institute will be an electrical library and a museum, to which, if space permits, an experimental laboratory may be added. Suitable accommodations will be provided for council and general meetings and the entertainment of members and their guests, and the house will be open at all reasonable hours. The work already accomplished is shown by the contents of the three yearly volumes of Transactions. These, however, will be surpassed by the volume now in press, which completes the record of the institute up to May, 1887.

— In Bulletin No. 26, issued recently from the department of zoölogy and entomology of the Michigan agricultural college, on p. 6, a typographical error makes the proper proportion of Paris green or London purple to water, for spraying apple-trees for the codling-moth, to be one pound of Paris green to two *gallons* of water; whereas the proportion should be one pound of Paris green or London purple to two barrels, or one hundred gallons, of water.

— We learn from the *Naturwissenschaftliche Rundschau* of May 21 that on May 3 and 4 the curves of the barographs at Berlin showed sudden changes of the atmospheric pressure which could not be accounted for by meteorological phenomena. This fact is of interest as being coincident with the Sonora earthquake. Von Bezold, who mentioned this matter in the Physical society of Berlin on May 6, calls to mind the fact that the eruption of Krakatoa on Aug. 27, 1883, was also accompanied by sudden changes of the atmospheric pressure in Europe.

— Porter & Coates announce a new edition of 'Amateur photographer,' with two new chapters on paper negatives and microscopic photography, by Ellerslie Wallace, jun.

— Botanists owe Professors Farlow and Trelease a debt of gratitude for the publication of their bibliography of North American fungi in the May number of the *Harvard university bulletin*, just issued. It contains a list of such works on North American fungi (excluding the Schizomycetes as belonging rather to the department of medicine than to botany proper) as are of greater or less value to working botanists. It is the first list of the kind yet published, and will show that the general belief of those not specialists in this branch of botany, that little has been written on North American mycology, is by no means correct. It includes a very large number of papers of a popular and indefinite character relating to fungi not specifically named which are scattered through various agricultural, horticultural, and other journals; the entries are in all cases accompanied by brief descriptive notes, which adds greatly to the value of the list; it contains also, when procurable, the place and date of birth of the authors included in the list. The most prolific author noted is M. C. Cooke, whose papers, including those published with other persons, number 71; other prominent authors are J. B. Ellis (50), W. G. Farlow (31), and M. J. Berkeley (30). Probably the complete list will contain more than seven hundred entries, of which nearly one-half are given in the present instalment, which reaches the letter H.

— In *Science* for May 20, p. 481, first column, second line, 'phenomenon' should read 'phenomenon in Assyrian.'

## LETTERS TO THE EDITOR.

*** *The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The occurrence of similar inventions in areas widely apart.

IN *Science* of May 20, Dr. Franz Boas has reviewed in a very courteous manner my plan of studying and exhibiting anthropological material, to which I am happy to make reply.

I think that Dr. Boas honors me overmuch in giving me the entire credit for a system which had taken possession of some men's minds before I was born. As your space will not allow an extended argument, I shall confine myself to general statements.

1. Whoever attempts to classify material must first have in his mind certain notions, ideas, or characteristics by means of which he will separate one object from another. These ideas let us call 'classific concepts.'

2. All curators of anthropological museums must recognize the following classific concepts: material, race, geographical areas, social organizations, environment, structure and function, and evolution or elaboration. Besides these, there are other minor concepts which enter into a more minute classification.

3. Every scientific anthropologist charged with a great collection has in his own mind decided the order in which these concepts should be considered in the distribution of material, and I consider this the greatest blessing to science. If all the museums in the world were arranged upon the same plan, only one set of philosophical problems could be considered, and the study would be correspondingly circumscribed. If, however, such a measure becomes necessary, I sincerely hope the plan will be that of the national museum at Washington. Let it be distinctly kept in mind that the only difference among curators is in the degree of prominence given to each concept.

4. There is another factor which enters into the arrangement of material, and that is those who are to study the material. For instance, there are archeologists, ceramists, musicians, technologists of many kinds, and students of war, religion, and the aesthetic arts, who desire to see, in juxtaposition, the specimens which they would study. On the other hand, there are ethnologists and sociologists who desire to see all that belongs to a consanguine race, or to a geographical area, in juxtaposition.

One of the most delightful *incentives technique* as the ruling concept is the great variety of intelligent people who can be brought into co-operation in the work. It seems that there is something for everybody on earth to do, and I attribute the phenomenally rapid growth, at little cost, of the national museum, to the great variety of minds that catch its spirit and are glad to work for it in their several spheres.

Now, in a museum properly constructed it is possible to arrange the cases in the form of a checkerboard, so that by going in a certain direction the parallels of cases represent races or tribes or locations. By inspecting the same cases in a direction at right angles to the former, the visitor may study all the products of human activity in classes according to human wants. At any rate, whatever the fundamental conception be, in any museum every thing should tend to enlist the sympathies and co-operation of the greatest diversity of mind.

Finally, as regards similarities in the products of industry of areas wide apart, I think Dr. Boas's suggestion about superficial similarities from unlike causes a very ingenious one, but it has nothing to do with the case. Except in a general way, his affirmation that similar effects proceed from different causes will hardly meet with acceptance, in the face of the axiom that 'like effects spring from like causes.'

In another place I have sought to show the gradations of similarities. Superficial, formal, or functional similarities in nature may spring from diametrically opposite motives, as in the case of mimicry. But according to the doctrine of chances, the possibility of similar effects diminishes with the complexity of the organization and the number of co-operating factors.

The perplexing question is this: Can these similarities be made to throw any light upon the migrations of men? The philosophical ethnologist is always in a 'double corner,' by reason of two interpretations of similarities, — the one arguing contact of some kind; the other, disconnected causes, whether similar or dissimilar it matters not.

I think it is a growing conviction that inventions of both customs and things spring from prior inventions, just as life springs from life, and that the sooner we recognize the fact that in the study of arts, institutions, language, knowledge, customs, religion, and races of men, we must always apply the methods and instrumentalities of the biologist, the sooner will our beloved science stand upon an immovable foundation.

There is a disposition to magnify the importance of museum specimens. The valuable thing about them is the knowledge we acquire concerning them. A museum is an encyclopaedia, with specimens instead of pictures. I hold, and would emphasize, the opinion that the explorer who goes among a people to study their entire creed and activity will do his work better by having in his mind the determination to bring each industry into comparison with the same activities in other times and places.

There is one thought which should always be borne in mind in considering the biological method of treating ethnological material. In the natural world some beings are monorganic, others are polyorganic. It is so in the history of human inventions, therefore in the arrangement of specimens there are things which must always appear in sets. No one should think of separating a suit of clothing, a full-rigged vessel, the entire outfit of the arrow-maker, potter, weaver, or other craftsman. Professor Putnam would not think of separating the entire contents of a mound. Each of these things mentioned is a polyorganic unit whose parts are just as much related as the parts of the human body.

In conclusion, it is but just to remark that during the two years in which I have had charge of the department of ethnology in the national museum, I have given no attention as yet to the west coast of America from California to Mount St. Elias. To this fact, and not to any fault in my system, must

be attributed the difficulty which Dr. Boas encountered in studying our material in comparison with his own from that region. O. T. MASON.

Washington, May 30.

### An American dialect society.

Referring to the letter by R. B. in *Science* of May 20, it is certainly possible to establish an American dialect society. Yet I believe it much the better way to have the work undertaken by the American philological association than to form a new society. In my opinion, the advance of philological science will be much more readily promoted by a combination of the various societies now existing than by the formation of others. Philology would be the gainer if the Oriental and Modern language associations could be united with the American under one control. The success of the American association for the advancement of science should teach that in union there is strength, and that a large society attracts not only more attention from the public, but brings to its meetings a much larger proportion, as I believe, of its own members. The work of a dialect society is so largely local in its character that it can best be done by a large number of persons. That such a work should be done needs little proof. The principal question is, By whom shall it be done? S. C. DERBY.

Columbus, O., May 24.

### The causation of consumption.

Within the last few years the attention of the medical profession has been more than ever turned to the consideration of the cause or causes of pulmonary consumption. The renewed interest in the etiology of this disease is owing to the discovery of the bacillus tuberculosis. This important event gave origin to two theories; the one holding that the only cause of consumption was the bacillus tuberculosis, and the other that the disease but furnished a *nidus* for the bacillus, and that hence its presence was not a cause, but an effect. This difference of opinion among physicians has not materially altered even to the present day; and, while the factors of the problem which give rise to this difference of opinion remain unsolved, it is savoring of dogmatism to say that it is decided that so and so is the cause of consumption.

As we proceed further in our investigation of the causation of consumption, we find the adherents of one theory placing great stress upon heredity, and, on the other hand, men of the highest authority and standing in the medical profession giving it as their opinion that there is no direct heredity other than that the child of phthisical parents starts in life with a small stock of vitality, and is thus rendered more liable to the invasion and the destructive influences of any and all diseases.

At the present state of the inquiry it seems somewhat too hasty to say just what the cause of pulmonary consumption may be; but it certainly appears that this cause is compound, being made up of at least three several elements: to wit, —

1°. The feeble vitality or resisting power with which the given organism enters upon life.

2° (*a*). The action of an environment upon this organism detrimental to the maintenance of a good general health; or (*b*) in some cases the existence of a state of debility after an acute disease.

3°. The organism thus influenced being exposed to the action of the bacillus tuberculosis.

The bacillus tuberculosis is so widely disseminated in the air we breathe, and distributed in the food we eat, that, were it the only or the main cause of consumption, we might expect the extermination of the human race within a few years.

We may plant corn upon unsuitable soil, and there will be no growth; we may plant it upon prepared soil and exclude the sunlight, heat, and moisture, and there will be no growth; and so the bacillus tuberculosis is deposited in the lungs of every one of us nearly every day, and yet it takes no hold upon the majority, because either the system is refractory to it, or our environment is such that it cannot develop. JAMES P. MARSH.

Green Island, N.Y., May 30.

### The equivalence in time of American marine and intracontinental tertiaries.

In a paper published in the May number of the *American journal of science*, Dr. C. A. White discusses the possibilities of correlating in detail the North American intracontinental and marine tertiaries, and refers to the identification by Prof. L. F. Ward of four species of plants from the tertiaries of the Mexican gulf border, with those found in the Laramie group. I am unable to refer to the report of Professor Ward, which has not yet reached this coast, and am therefore unaware whether the plants referred to are from the country east or west of the Mississippi River; but I would take this occasion to call attention again to the opportunities afforded for the establishment of such correlations, in north-western Louisiana, south-western Arkansas, and the adjacent portions of Texas and the Indian Territory, where the marine formations, still recognizable in detail by their characteristic shells, are indefinitely split up, both horizontally and vertically, into a maze of marine outliers and fresh and brackish water deposits, of the equivalence and continuity of which there can be no possible question. Among these, certain fresh-water deposits on the upper Red River in Louisiana are extremely rich in well-preserved leaves and fruits, of which a collection (deposited at the University of Mississippi at Oxford) was made by me in 1869. Among my publications setting forth these facts, I have, in a paper read at the Indianapolis meeting of the American association for the advancement of science in 1871, pointedly alluded to the probable original continuity of this 'Mansfield group' of Louisiana with intracontinental tertiaries, and the further probability, that, by means of remaining outliers, at least a chronological scale for parallelizing these formations might be established along the shallow connecting trough outlined by the cretaceous shore-lines. While my supposition that the cross-timbers of Texas were also of tertiary age, has since been disproved, I am not aware that any exhaustive examination of the region lying between the Red and Arkansas rivers in the Indian Territory has been made; yet it is there that such direct connection must have existed, if at all within tertiary times. The striking increase of the lignitiferous facies toward the north-western border of the Gulf tertiary area, culminating in the appearance of bands of fresh-water limestone at Mansfield and north-westward; the fan-like expansion, in Arkansas and Louisiana, of the older por-

tion of the narrow bands formed by the marine stages in Mississippi and Alabama; with a manifest north-westward trend of such deposits as are continuously traceable in north-western Louisiana, while the later stages are abruptly deflected to the south-west, — all points to a rapidly progressing elevation of the axial cretaceous trough, that may, or may not, have completely separated the interior from the Gulf waters before the beginning of the tertiary period. In any event, the region referred to appears to me to be a critical one, deserving of exhaustive examination in advance of many others that offer only a subordinate interest in comparison to the problem of the correlation of the intracontinental and the marine tertiary. E. W. HILGARD.

Berkeley, Cal., May 17.

## The pelvis of the dugong.

As far as I am aware, the pelvis of Halicore australis has never been properly described or figured.

Last fall I had the opportunity of examining, here at my father's establishment, six ligamentary skeletons, embracing both sexes, of this animal. A few hasty notes made at the time, and a section of vertebrae, including the pelvis (in which, unfortunately, the ischia have been torn asunder and separated from their haemapophysis), is all the material I can lay hands on, now that I have time to look the matter up: consequently my drawing and description cannot include a few points that I would wish.

In all six cases the fourth post-dorsal vertebra is the first sacral. The ilia are connected to the distal

ends of its diapophyses by short ligaments. The ends of these diapophyses are greatly swollen dorsoventrally, their vertical diameter being thirty-three millimetres, whereas the preceding one measures but ten millimetres. The diapophyses of the two succeeding (sacral) vertebrae are also decidedly thicker at the ends than is the case in either the last lumbar or the succeeding caudals. Anchylosed to the ilia are the ischia lying in the same line, and showing their junction by a prominent swelling in the mass of the bone.

The distal ends of the ilia were connected with each other by a short ligament, and separated from the apex of the haemapophysis of the second succeeding vertebrae by but a few millimetres, connected to it either by a ligament or muscle, but which it is now too late to determine.

The ilium is 109 millimetres in length; the ischium, 102; the transverse diameter of its distal end, 46; the anterior-posterior length of the symphysis ischia, 34.

The first haemapophysis consists of two straight V-shaped bones 30 millimetres long, 29 millimetres apart at bases, with points diverging to a distance of 51 millimetres. The next, to which the ischia join, has its two parts curving inward, leaving an oval opening, the extremities not quite meeting, and ligamentously connected. The succeeding haemapophyses have their ends anchylosed, and are V-shaped.

The point that I especially wish to emphasize is, that the pelvis is not *vertical* to the axis of the vertebral column, but lies at practically the same angle as ordinarily obtains in the mammalia.

In the six specimens examined, two had nineteen thoracic vertebrae, while four had but eighteen. All had three lumbar vertebrae. The thoracic are generally stated as being nineteen in number: with these this was the exception.

It is further to be noticed that the dugong appears to be an exception to the rule that when the number of thoracic vertebrae is increased or diminished there is a compensating diminution or increase in the number of lumbar vertebrae. HENRY L. WARD.

Rochester, N.Y., May 24.

## A cretaceous river-bed.

The springs at San Marcos, Hays county, Tex., where the San Marcos River rises full grown from the earth, with a steadiness of flow in marked contrast with the majority of Texas rivers, are, aside from their scientific aspects, sufficiently interesting to have been a subject of popular speculation and newspaper discussion ever since the settlement of Texas. The theories that have been advanced are various, from the popular idea that it is sufficiently explained by the presence of a cave full of water under the hill, to the explanation proposed by an imaginative newspaper editor, that the water comes underground from the Rocky Mountains.

I have not felt it necessary to familiarize myself with the details of this discussion, since, although my conclusions may be to some extent old, the proof is certainly new; for the general principle upon which it is based has been but recently announced by Mr. Robert T. Hill in the *American journal of science* for April (xxxiii. p. 29); namely, that there exists between the earlier cretaceous strata of Texas and the superimposed rocks a plane of 'non-conformity by erosion,' indicating an interval of emergence between the two periods of cretaceous rock formation.

The strata in the vicinity of San Marcos not only furnish a striking proof of the truth of this principle, but they become a key to whatever is mysterious in the origin of the San Marcos River.

The accompanying section roughly represents the rocks exposed by the San Marcos at its source.

No better stratigraphical landmark than the stratum *bb*, the Exogyra arietina marl, could be desired. The exposures at San Marcos are typical ones, containing an unusually large proportion of perfect bivalve specimens of Exogyra arietina R., besides the usual smaller quantity of Gryphara Pitcheri, etc. Its exposures are from fifty to one hundred feet above the river-level, and, in connection with the Ostrea carinata bed below, furnish conclusive proof that these rocks are of the Washita division of the *earlier* or Texas cretaceous; lacking, however, the uppermost members of that series.

In the little valleys back of the portion of the section marked *aa*, I found a conglomerate composed of fragments of the hard earlier limestones and

pebbles cemented with white limestone, and gradually changing upward into a firm, barren, homogeneous limestone.

This formation was in continuation of, or sometimes below, the horizon of the Exogyra arietina marl. Here, then, was the solution of the problem of the San Marcos. The rocks before me were of the *later* cretaceous, deposited upon the gravel and shingle which had formed the bed of a river during the period of emergence. They had choked up and rendered impervious the superficial layers of the river-bed, but doubtless left the lower gravel and sand beds in as good condition for carrying water as ever. To make the evidence complete, I found, on examination of the rock *aa*, which lies only a few feet above the river, that it is the soft limestone of the later cretaceous, containing numerous specimens of Gryphaea laeviuscula R., — a fossil found in great abundance a short distance east and north of Austin, and there occurring at the top of the Austin limestone.

We have, then, the channel, and need only to account for the water to fill it. The Blanco River, in a westerly direction from San Marcos, is about fifteen miles distant. In the upper part of its course it is a running stream of considerable volume; but below the point west of San Marcos it loses size rapidly, and at the point where the International and great northern railroad crosses it, and below, it is for the greater part of the year only a dry bed with occasional pools of standing water.


SECTION OF CRETACEOUS ROCKS AT SAN MARCOS, HAYS COUNTY, TEX., LOOKING SOUTH.

*DDD*, principal springs; *B*, hill upon which is the Chautauqua assembly building; *aa*, later cretaceous limestone, with Exogyra laeviuscula R.; *bb*, Exogyra arietina marl; *cc*, firm limestone, with Terebratula Wacoensis R. and Pecten quadricostatus Sowerby; passing into *dd*, thin-bedded soft limestone, with Ostrea carinata Law and numerous fossils of types Ostrea, Gryphaea, Turritella, Pecten, Cardium, Cypricardia, Trigonia, Toxaster, and Ammonites; *ee*, hard but broken limestone, with Caprinas.

It has evidently cut through the overlying deposits, till it has reached the ancient bed of the San Marcos, which, thus filled with water, has been enabled to clear away whatever later deposits lay upon its ancient bed back to the present source of the San Marcos River.

To a geologist the question would at once occur, Why has not the current opened the whole of the old bed, and so caused the abandonment of the present bed of the Blanco long ago? The answer lies in the configuration of the older cretaceous strata at its present source. The old river had cut under what was the overhanging cliff of the hard limestone *cc*, causing it to dip abruptly, as represented in above section, and then found the least resistance in cutting a channel from the softer Ostrea carinata bed rather than in carrying away the fallen mass of the harder limestone. Hence the rocks of the old river-bed proper, at *aa*, though very soft, are protected from further erosion from beneath by the stratum *cc*.

There are, however, small springs at *s*, which show that the whole of the old bed is to some extent permeated by the waters of the underground river.

The extent and direction of this underground channel, and the determination of other streams than the Blanco which may be tapped by it, are promising subjects of future investigation, which I hope at an early date to undertake, not only in the hope of gaining, by a study of the amount of erosion of the older rocks, some idea of the duration of the interval between the two periods of rock formation, but of obtaining some information concerning the fresh-water life of that period. EDWIN J. POND.

Austin, Tex., May 18.

## Electrical phenomena at the Washington monument.

In various numbers of *Science* of recent dates have appeared notices of certain electrical phenomena experienced on western mountain-peaks. The peculiar effects experienced consist in general of a hissing or crackling sound accompanying single discharges, or a continuous flow of sparks, and the characteristic tingling sensation when a finger is presented to any metallic object near by. These experiences, despite the common belief, are not rare, nor confined to certain persons. At Pike's Peak these electrical manifestations are of frequent occurrence, and a list has been published (*Report of chief signal officer*, 1882, p. 893) showing the accompanying meteorological conditions in fifty-six instances, and proving that these electrical phenomena are closely connected with the occurrence of hail, snow, and thunder-storms. At these times it is easy to obtain sparks from woollen or fur garments, and to receive shocks on opening the door of the stove, or touching any metallic body. Again, at Fort St. Michael's (*Ibid.*, 1881, p. 768) during the coldest weather of winter, and always after a snow fog, "the air is so electrified that the hair upon any loose fur stands up, and a spark can be drawn by presenting a finger to the tip of a single hair."

In all these cases the observer may be considered as an insulated (perhaps, as in the case of one of your correspondents, he may stand upon a thick woollen Navajo blanket) body, which, because of the electrification of the air, acquires a charge. Contact with a body, in better, although perhaps not very good, connection with the ground, results in a discharge, with the described effects, varying in intensity with the degree of electrification. This condition of things is in part, I think, imitated in some experiments I have made at the top of the Washington

monument, during thunder-storms. The apparatus used consists of a large insulated collector, a modified Mascart electrometer, and Mascart insulators and the necessary adjuncts. As the thunder-clouds approach, the electrometer-needle becomes very active, and, after considerable oscillation, begins to move steadily in one direction (generally negative), until a deflection indicating, for example, a potential of three thousand volts, is reached, when, simultaneous with a flash of lightning, occurs a quick drop to zero, to begin again slowly to increase, and then more rapidly, until the next flash of lightning. So perfect is this correspondence, that the lightning can be timed as accurately from the indications of the electrometer as by direct vision. If at this time a finger be held out towards the collector, sparks are given, with the accompanying crackling and hissing, and the tingling sensation in the finger. In such a case, the observer is simply grounding the insulated charged collector. The greatest sparking distance, in our experience thus far, as determined by direct measurement, was a little under four millimetres. I have never found any difference (as one of your correspondents intimates) in the sparking distance, depending on the finger. The potential of the air, however, as shown by the electrometer readings, is constantly fluctuating, often very rapidly, and at certain times the potential of the air is zero. Of course, a finger presented at such a time, fails to draw a spark.

To imitate more closely the conditions of the mountain-side, the previous arrangement was reversed, and the observer insulated by standing on a Navajo blanket folded several times. This is but poor insulation, though it answered the purpose. Standing close to the open window of the monument, the results were as anticipated. My hair stood on end, and, on presenting a knuckle to the iron framework, a spark passed. I should remark that these effects were only experienced during a thunder-storm. I tried the experiment at other times, without success.

There are two further points of interest to which attention is called. Professor LeConte has instanced (*Science*, ix. No. 205) the case of the survey party on one of the San Juan mountains, where "a sudden cessation of the distressing electrical effects was experienced whenever there occurred a flash of lightning." This is confirmed by what precedes; and our electrometer readings make it certain that every lightning-flash relieves the electrical tension, and gives us also the means of estimating the electromotive force producing the disruptive discharge, and the electric strength of the air, under natural conditions. The second point of interest is the effect of electrification upon the water-particles present. Lord Rayleigh has shown how the character and direction of a fine stream of water may be altered by electrical influences; for example, a stick of sealing-wax, when rubbed, distorting a fine jet of water. Effects of the same character I noticed in the jet of water issuing from the nozzle of the collector. When the collector was 'grounded,' the stream would preserve a certain even, rounded character, breaking into drops some four inches away from the place of issue. Removing the ground connection, the stream would twist and split into sprays with the increasing electrification. Simultaneous with a flash of lightning, this distortion ceased, and for the moment the stream resumed its first character, only to be again distorted, and repeat the same operation with the next lightning-flash.

ALEXANDER MCADIE.

Cambridge, May 25.

## Railway jubilee, Paris, 1887.

I am requested by the executive committee in Paris to ask the favor of appealing through your columns for the loan of any objects, books, medals, drawings, etc., relating to the history of railways, and means of transportation generally, both ancient and modern, in this country.

I am directed, also, to say that all expenses of forwarding and returning the same to the lenders, packing and unpacking, will be defrayed by the executive, that each object will be insured for the value the lender may put upon it, and that special attendants will be told off for their safe custody.

All communications on the subject may be addressed to M. G. Senechal, 8 Faubourg Montmartre, Paris, or to Mr. George L. Fowler, M.E. (of New York City), commissioner in charge for the United States, Palais de l'Exposition, Bois de Vincennes, Paris, France. By addressing communications direct to Paris, much valuable time will be saved.

JOHN W. WESTON.

Chicago, Ill., May 23.

## The maxillo-palatines of Tachycineta.

With respect to what your correspondent says in regard to a drawing of mine, I can only say that the skull of T. thalassina from which it was made is a perfect one, and my copy correct in all particulars. This is more than I can say for the reproduction of it (*Science*, No. 223, fig. 1); but however this may be, it at least affords me now the opportunity to yield gracefully to my critic, for I am free to confess that the maxillo-palatines of that skull are 'imperfect' and 'broken off' — on paper — by Mr. F. A. Lucas; as any one may see who cares to compare my drawing in the Proceedings of the Zoölogical society of London (Dec. 1, 1885, p. 899, fig. *F*) with his copy of it in *Science*, to which I refer above.

R. W. SHUFELDT.

Fort Wingate, N.Mex., May 20.

## No parietal foramen in Tritylodon.

Dr. George Baur of the Peabody museum, New Haven, has been recently studying the fossil vertebrates in the British museum of natural history. At my request he has kindly made a careful study of the skull of Tritylodon, and finds that Professor Owen's observation of a foramen between the parietal bones is incorrect. He writes (London, May 8), "Ich habe Tritylodon hier genau untersucht, ein Parietal-Foramen existirt *nicht*; es ist wenigstens keine Spur desselben nachweisbar." This contradicts, without question, the suggestion I made in a recent number of *Science*, upon the strength of Professor Owen's observation, that there was probably a pineal eye of considerable size in Tritylodon. I hasten to make the correction, before the suggestion goes any further. Although it has proved incorrect, I think any one who will examine Professor Owen's figure and description of the Tritylodon skull (*Quart. journ. geol. soc.*, 1884) will admit that there was sufficient ground for this conjecture.

HENRY F. OSBORN.

Princeton, N.J., May 26.

## Calendar of Societies.

*Biological society, Washington.*

*May* 28. — R. E. C. Stearns, The protective device in the 'carrier shell'— Xenophora; R. T. Hill, The true geological horizon of some hitherto unplaced faunas; G. Brown Goode, Some Japanese pictures of fishes; John B. Smith, Incipient species of insects; W. B. Barrows, Insect-food of the English sparrow.

*Philosophical society, Washington.*

*May* 25. — M. H. Doolittle, Association ratios; Marcus Baker, A collection of solutions of the trisection problem.

*Society of arts, Boston.*

*May* 26. — M. M. Slattery, Electrical distribution by the aid of induction coils.

*Engineers' club, St. Louis.*

*May* 18. — H. A. Wheeler, The relative economy of machine and hand drilling.

## Publications received at Editor's Office, May 23-28.

GREENOUGH, Horatio, letters of, to his brother, Henry Greenough. Ed. by Frances Boott Greenough. Boston, Ticknor. 250 p. $1.25.

HUNT, E. M. Principles of hygiene. New York and Chicago, Ivison, Blakeman, & Co. 382 p. 12°.

MOREL, V. New treatment of the affections of the respiratory organs and of blood poison by rectal injections of gases after the method of Dr. Bergeon. Tr. by L. E. Holman. Philadelphia, Queen. 21 p 8°. 25 cents.

NEW HAMPSHIRE, third annual report of the state board of health of, for the year ending April 30, 1884. Concord, State. 335 p. 8°.

NEW JERSEY, fourth annual report of the board of health of the state of, 1880. Camden, Sinnickson Chew. 378 p. 8°.

NEW YORK, transactions of the Medical society of the state of, for the year 1860. Albany, C. van Benthuysen. 280 p. 8°.

PUBLISHERS' bulletin, the. Vol. i. No. 1. *m.* New York, W. J. Carlton. 20 p. f°.

SERBATI, A. R. The ruling principle of method applied to education. Tr by Mrs. William Grey. Boston, Heath. 363 p. 12°.

WILLISTON, S. W. Synopsis of the North American Syrphidae. (U. S. nat. mus., bull. No. 31.) Washington, Government. 335 p. 8°.

YONGE, C. M. Cameos from English history. Forty years of Stewart rule (1603-43). New York, Macmillan. 400 p. 16°. $1.25.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 3, 1887.

## ADVANCES IN METEOROLOGY.

DURING Mr. William Ferrel's service as a professor in the signal office for the past few years, from which he has recently retired, his chief occupation was the preparation of a work on meteorology that should represent the modern attitude of the science, and serve as a guide in the theoretical questions that continually arise in the prosecution of the practical studies of our weather-bureau. The book, originally intended to be a 'professional paper,' now appears as an appendix to the late chief signal officer's last report, published by authority of the secretary of war. This form of publication involves some inconveniences: the making of the book is not so good as such a book deserves; the current page-heading, 'Report of the chief signal officer,' is an unfortunate example of formality; but the matter of the book is a long way beyond that of any English work on the subject, and it will take and hold the place of a standard authority.

Its mathematical treatment of the subject carries it beyond most readers. A more popular work by the same auther would be a boon to teachers and students alike, and would do more than this advanced treatise can, to correct the misconceptions that still prevail in most text-books, and to induce a consideration of deductive, dynamical meteorology as well as of inductive, statistical meteorology, that now takes so large a share of the scholar's time.

The problem of the general circulation of the atmosphere serves particularly well to illustrate the need of this change of view. It is, moreover, a subject in which Professor Ferrel holds a peculiarly high position.

Instead of attempting to review all of the 'Recent advances,' I shall therefore refer only to this great problem, whose successful solution illustrates the high value of our author's methods.

First, some thirty years ago, Ferrel made the initial steps towards its rational solution; and, with a single exception, there has been no one else working in this profitable field until a few of the European mathematical meteorologists lately entered it.

A short acquaintance with the study will suffice to show that the temperature, pressure, and motion of the atmosphere must be closely interdependent. Difference of temperature, as between equator and poles, must bring about difference of pressure; difference of pressure will cause winds; and the winds would soon restore equilibrium, if the difference of temperature were not continually maintained. The equilibrium cannot be reached: the winds will flow in obedience to residual differences of pressure that they cannot reduce to zero as long as the sun shines.

The early attempts at the further solution of this problem generally led to the statements that the warmth of the torrid zone caused the equatorial belt of low pressure; that the cold of the polar regions ought to cause areas of high pressure there, which were somehow reversed into lower pressures than at the equator, especially in the antarctic regions; that the belt of high pressure around the tropics was due to the crowding of the upper winds as they overflowed from the equator north and south along the converging meridians. The trade-winds, and the anti-trades above them, were normal members of this general circulation; but the prevailing west-south-west winds of the north temperate zone, and west-north-west winds of the south temperate zone, were not so easily explained. Dove called them 'equatorial' winds, and saw the compensating return current in the occasional north-east or 'polar' winds, which are now known to be 'accidental' or cyclonic in origin, and quite apart from the general planetary circulation. Maury explained them by supposing a curious crossing of currents at the tropical belts of high pressure. In the torrid zone the equatorial overflow was aloft; but outside of the tropics it came down to sea-level, and the return current ran aloft, — a most arbitrary and unreasonable hypothesis. Views hardly more logical than these still prevail in many text-books. It is indeed now almost universal to ascribe the tropical belts of high pressure to the convergence of the meridians; though why the crowding of the air should disappear in higher latitudes, where the meridians converge faster, is not explained. Sprung calls attention, in his excellent 'Lehrbuch der Meteorologie,' to the firm hold that this unphysical explanation has obtained, and wonders at the very slow awakening of meteorologists to Ferrel's theory. It is unfortunate that a theory so greatly needed has been so obscurely published. The *Nashville journal of medicine and surgery* first concealed it in 1856. *Runkle's mathematical monthly* gave it a more expanded

statement, but only carried it before a limited circle of readers, from 1858 to 1860. A briefer and more popular account appeared in the *American journal of science* in 1861, when school-masters might have seen it more generally, had not their attention been distracted by the war. Other brief articles have appeared in the same journal and in *Nature*. About ten years ago, an extended memoir, entitled 'Meteorological researches,' appeared as appendices to the coast-survey reports for 1877 and 1878, where they were said to be 'for the use of the coast pilot.' Like the earlier articles, these researches were too advanced and too little known to reach the school-master directly; but a review of them in *Nature* by Archibald has brought them before British meteorologists, where they were truly as much needed as with us. Still, it is only in Germany that they have had much effect on recent text-books, and it is to be feared that even the present work may not reach the readers who ought to have it: hence the hope expressed already, that Professor Ferrel may write a more popular book. We may hope, further, that it may find a way into our schools through some regular book-publishers rather than through dealers in second-hand government reports. Reflecting on this, how different was the immediate conquest of popular interest by Maury's famous 'Physical geography of the sea' from the long obscurity of Ferrel's 'Essay on the winds,' and how different the brief life of Maury's theories from the continually increasing vitality of Ferrel's! Perhaps, after all, the *Nashville journal* is a good medium of publication for the young scientist.

Ferrel showed in his first article, that, in consequence of the earth's rotation, all the atmosphere outside of the tropical belts of high pressure must have a general motion from west to east, and this disposed of Dove's north-east, 'polar' wind as a member of the planetary circulation. He also showed, that, as a consequence of the general eastward motion, the atmosphere would be drawn from the poles and thrown toward the tropics, thus causing the tropical belts of high pressure, and reversing the polar high pressure, that would be caused by the cold of the frigid zone, into polar low pressures. But, in order to explain the oblique recession of the surface winds in temperate latitudes from the tropics towards the poles, Ferrel then reversed the whole circulation of the winds at the tropics, placing the return current from the pole at the top, while it is at the bottom in the torrid zone.

The correction of this inversion appeared unconsciously and independently in a brief paper 'On the grand currents of atmospheric circulation,' by Prof. James Thomson, read before the British association at Dublin in 1857. It occupies but little more than a page in the report of the meeting, and has never been expanded in the more complete form that it fully deserved. Thomson, like Ferrel, saw that the general motion of the atmosphere must be eastward, except in the trade-wind belt, and that the centrifugal force of the great polar whirls thus generated would decrease the pressure at the vortices or poles; but Thomson perceived also that the lowest part of the oblique return current, losing velocity by friction with the earth, tends to flow towards the pole, to supply the partial void in the central parts of the vortex. He states explicitly, "that, in temperate latitudes, there are three currents at different heights; that the uppermost moves towards the pole, and is part of a grand primary circulation between equatorial and polar regions; that the lowermost moves also towards the pole, but is only a thin stratum forming part of a secondary circulation; that the middle current moves from the pole, and constitutes the return current for both the preceding; and that all these three currents have a prevailing motion from west to east in advance of the earth." This was a most significant addition to Ferrel's first paper, but it lacked quantitative completeness. Ferrel's second paper modifies his first statements and diagrams, introducing the three-current system, and referring to Thomson's paper in a final paragraph, from which we may infer that the correction had occurred independently to our author. Be this as it may, Thomson's suggestion deserves more recognition than it has generally received. A second modification of the plan of general circulation appeared in the 'Researches' of 1877, in which the north-east winds of the arctic regions are omitted from the scheme of winds that would appear on a homogeneous earth, and thus by implication referred to a class that may be called continental, as depending directly and indirectly on the diversity of land and water surface on the globe: they are not known to occur around the south pole, where the surface is so largely water. Thus simplified, the scheme appears in the present work, where it demands the closest attention.

Another great generalization is that which connects cyclonic storms with the general circulation. It may be summarized as follows: a cyclone, or revolving storm, that appears in most symmetrical development in the tropical regions, has a centre of decidedly low pressure, surrounded by a ring of slightly higher pressure than the normal; outside of the ring, the surface winds move away from the centre and turn to the right of a radius; inside of the ring, the surface winds cir-

culate around the centre, blowing obliquely along an inward, ascending, left-handed spiral with increasing velocity, until they turn to an outward spiral aloft. The central low pressure in this case is primarily due to its high mean temperature, and secondarily to the centrifugal force of the whirl and the deflective force of the earth's rotation. This is a cyclone with a warm centre. The general winds of the northern hemisphere constitute a cyclone with a cold centre: their centre of low pressure is at the pole, and their ring of high pressure is around the tropic of Cancer, and, except for the lower member of surface winds, the currents approach the centre aloft, along a left-handed, inward, descending spiral, and turn to an outward spiral below. In this case, the pressure at the centre would be high, owing to the cold, were it not lowered by the centrifugal force of the whirl. In warm-centred cyclones, the steepest gradients and highest velocities are near the surface: in cyclones of cold centres, they are in the lofty regions. The enormous progress marked by such a generalization may be appreciated by reading the vague and vain theories of other authors. Ferrel's theory of tornadoes is another monument of deductive study, checked by a fulness of knowledge of fact, as far as observations and records allow.

It is not desired to imply by this reference to deductive methods that meteorological observations and their statistical study should in any way decrease: they are, of course, the essential foundation for further study. But it is a matter of regret that so few willing and interested observers go beyond this foundation-work far enough to discover the intense interest of the broader, physical study of meteorological phenomena. We may take pride in recognizing Espy and Ferrel as leaders in modern meteorology, but we must take care also that they have followers.

W. M. DAVIS.

## *HYPNOTISM IN FRANCE.*[1]

THE voluntary production of those abnormal conditions of the nerves which to-day are denoted by the term 'hypnotic researches' has manifested itself in all ages and among most of the nations that are known to us. Within modern times these phenomena were first reduced to a system by Mesmer, and, on this account, for the future deserve the attention of the scientific world. The historical description of this department, if one intends to give a connected account of its development, and not a series of isolated facts, must begin with a notice of Mesmer's personality, and we must not confound the more recent development of our subject with its past history.

[1] Translated for *Science* from *Der Sphinx*.

The period of mesmerism is sufficiently understood from the numerous writings on the subject, but it would be a mistake to suppose that in Braid's 'Exposition of hypnotism' the end of this subject had been reached. In a later work I hope to show that the fundamental ideas of biomagnetism have not only had in all periods of this century capable and enthusiastic advocates, but that even in our day they have been subjected to tests by French and English investigators from which they have issued triumphant.

The second division of this historical development is carried on by Braid, whose most important service was emphasizing the subjectivity of the phenomena. Without any connection with him, and yet by following out almost exactly the same experiments, Professor Heidenhain reached his physiological explanations. A third division is based upon the discovery of the hypnotic condition in animals, and connects itself to the *experimentum mirabile*. In 1872 the first writings on this subject appear from the pen of the physiologist Czermak; and since then the investigations have been continued, particularly by Professor Preyer.

While England and Germany were led quite independently to the study of the same phenomena, France experienced a strange development, which shows, as nothing else could, how truth everywhere comes to the surface, and from small beginnings swells to a flood which carries irresistibly all opposition with it. This fourth division of the history of hypnotism is the more important, because it forms the foundation of a transcendental psychology, and will exert a great influence upon our future culture; and it is this division to which we wish to turn our attention. We have intentionally limited ourselves to a chronological arrangement, since a systematic account would necessarily fall into the study of single phenomena, and would far exceed the space offered to us.

James Braid's writings, although they were discussed in detail in Littré and Robin's 'Lexicon,' were not at all the cause of Dr. Philips' first books, who therefore came more independently to the study of the same phenomena. Braid's theories became known to him later by the observations made upon them in Béraud's 'Elements of physiology,' and in Littré's notes in the translation of Müller's 'Handbook of physiology;' and he then wrote a second brochure, in which he gave in his allegiance to Braidism. His principal effort was directed to withdrawing the veil of mystery from the occurrences, and by a natural

explanation relegating them to the realm of the known. The trance caused by regarding fixedly a gleaming point, produces in the brain, in his opinion, an accumulation of a peculiar nervous power, which he calls 'electrodynamism.' If this is directed in a skilful manner by the operator upon certain points, it manifests itself in certain situations and actions that we call hypnotic. Beyond this somewhat questionable theory, both books contained a detailed description of some of the most important phenomena; but with the practical meaning of the phenomena, and especially with their therapeutic value, the author concerned himself but slightly. Just on account of this pathological side, however, a certain attention has been paid to hypnotism up to the present time.

In the year 1847 two surgeons in Poictiers, Drs. Ribaut and Kiaros, employed hypnotism with great success in order to make an operation painless. "This long and horrible work," says a journal of the day, "was much more like a demonstration in a dissecting-room than an operation performed upon a living being." Although this operation produced such an excitement, yet it was twelve years later before decisive and positive official intelligence was given of these facts by Broca, Follin, Velpeau, and Guérinau. But these accounts, as well as the excellent little book by Dr. Azam, shared the fate of their predecessors. They were looked upon by students with distrust, and by the disciples of Mesmer with scornful contempt.

The work of Demarquay and Giraud Teulon showed considerable advance in this direction. The authors, indeed, fell back upon the theory of James Braid, which they called stillborn, and of which they said, "*Elle est restée accrochée en route;*" but they did not satisfy themselves with a simple statement of facts, as did Gigot Suard in his work that appeared about the same time. Through systematic experiments they tried to find out where the line of hypnotic phenomena intersected the line of the realm of the known. They justly recognized that hypnotism and hysteria have many points of likeness, and in this way were the precursors of the present Parisian school. They say that from magnetic sleep to the hypnotic condition an iron chain can be easily formed from the very same organic elements that we find in hysterical conditions.

At the same time, as if to bring an experimental proof of this assertion, Lasigue published a report on catalepsy in persons of hysterical tendencies, which he afterwards incorporated into his larger work. Among his patients, those who were of a quiet and lethargic temperament, by simply pressing down the eyelids, were made to enter into a peculiar state of languor, in which cataleptic contractions were easily produced, and which forcibly recalled hypnotic phenomena. "One can scarcely imagine," says the author, "a more remarkable spectacle than that of a sick person sunk in deep sleep, and insensible to all efforts to arouse him, who retains every position in which he is placed, and in it preserves the immobility and rigidity of a statue." But this impulse also was in vain, and in only a few cases were the practical tests followed up with theoretical explanations.

Unbounded enthusiasm and unjust blame alike subsided into a silence that was not broken for ten years. Then Charles Richet, a renowned scientist, came forward in 1875, impelled by the duty he felt he owed as a priest of truth, and made some announcements concerning the phenomena of somnambulism; and in countless books, all of which are worthy of attention, he has since then considered the problem from its various sides.

He separates somnambulism into three periods. The word here is used for this whole class of subjects as Richet himself uses it; viz., *torpeur*, *excitation*, and *stupeur*. In the first, which is produced by the so-called magnetic passes and the fixing of the eyes, silence and languor come over the subject. The second period, usually produced by constant repetition of the experiment, is characterized chiefly by sensibility to hallucination and suggestion. The third period has as its principal characteristics supersensibility of the muscles, and lack of sensation. Yet let it be noticed that these divisions were not expressed in their present clearness until 1880; while in the years between 1872 and 1880, from an entirely different quarter, a similar hypothesis was made out for hypnotic phenomena.

Jean Martin Charcot, the renowned neurologist of the Parisian Salpêtrière, without exactly desiring it, was led into the study of artificial somnambulism by his careful experiments in reference to hysteria, and especially by the question of *metallotherapie*, and in the year 1879 had prepared suitable demonstrations, which were given in public lectures at the Salpêtrière. In the following years he devoted himself to closer investigation of this subject, and was happily and skilfully assisted by Dr. Paul Richer, with whom were associated many other physicians, such as Bourneville, Regnard, Féré, and Binet. The investigations of these men present the peculiarity that they observe hypnotism from its clinical and nosographical side, which side had until now been entirely neglected, and that they observe patients of the strongest hysterical temperaments. "If

we can reasonably assert that the hypnotic phenomena which depend upon the disturbance of a regular function of the organism demand for their development a peculiar temperament, then we shall find the most marked phenomena when we turn to an hysterical person."

The inferences of the Parisian school up to this time are somewhat the following, but their results, belonging almost entirely to the medical side of the question, can have no place in this discussion. They divide the phenomena of hystero-hypnotism, which they also call *grande hystérie*, into three plainly separable classes, which Charcot designates catalepsy, lethargy, and somnambulism.

Catalepsy is produced by a sudden sharp noise, or by the sight of a brightly gleaming object. It also produces itself in a person who is in a state of lethargy, and whose eyes are opened. The most striking characteristic of the cataleptic condition is immobility. The subject retains every position in which he is placed, even if it is an unnatural one, and is only aroused by the action of suggestion, from the rigor of a statue to the half life of an automaton. The face is expressionless, and the eyes wide open. If they are closed, the patient falls into a lethargy.

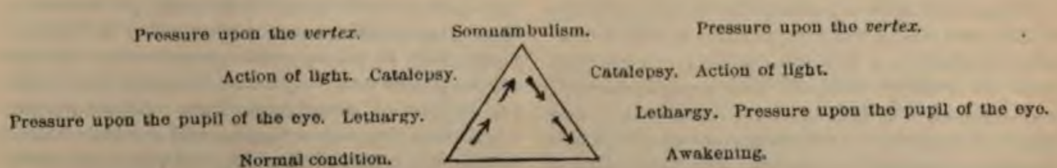
In this second condition, behind the tightly closed lids, the pupils of the eyes are convulsively turned upward. The body is almost entirely without sensation, or power of thought. Especially characteristic of lethargy is the hyper-excitability of the nerves and muscles (*hyperexcitabilité neuromusculaire*), which manifests itself at the slightest touch of any object. For instance, if the extensor muscles of the arm are lightly touched, the arm stiffens immediately, and is only made flexible again by a hard rubbing of the same muscles. The nerves also react in a similar manner. The irritation of a nerve-trunk not only contracts all the small nerves into which it branches, but also all those muscles through which it runs.

Finally, the somnambulistic condition proceeds from catalepsy or from lethargy by means of a slight pressure upon the *vertex*, and is particularly sensitive to every psychical influence. In some subjects the eyes are open, in others closed. Here, also, a slight irritation produces a certain amount of rigor in the muscle that has been touched, but it does not weaken the antagonistic muscle, as in lethargy, nor does it vanish under the influence of the same excitement that has produced it. In order to put an end to the somnambulistic condition, one must press softly upon the pupil of the eye, upon which the subject becomes lethargic, and is easily roused by breathing upon him. In this early stage, somnambulism appears very infrequently.

Charcot's school also recognize the existence of compound conditions, the history of whose symptoms we must not follow here. These slightly sketched results, as well as a number of other facts, were only obtained in the course of several years; yet in 1882 the fundamental investigations of this school were considered virtually concluded. Then Dumont-pallier, the head of the Parisian Hospital pitié, came forward with a number of observations, drawn also exclusively from the study of hystero-hypnotism, and yet differing widely from those reached by the physicians of the Salpêtrière. In a long series of communications, he has given his views, which have in their turn been violently attacked, especially by Magnin and Bérillon. I give only the most important points.

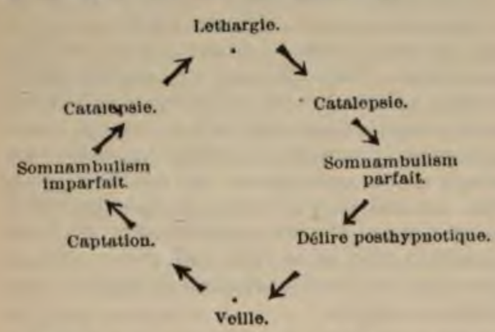
According to these men, the hyper-excitability of the nerves and muscles is present not only in the lethargic condition, but in all three periods; and in order to prove this, we need only apply the suitable remedy, which must be changed for each period and every subject. Slight irritations of the skin prove this most powerfully. A drop of warm water or a ray of sunshine produces contractions of a muscle whose skin-covering they touch.

Dumont-pallier and Magnin accede to the theory of intermediate stages, and have tried to lay down rules for them with as great exactness as Charcot's school. They also are very decided about the three periods, whose succession does not appear to them as fixed; but they discovered a new fundamental law which regulates the production as well as the cessation of the condition, — *La cause qui fait, défait*; that is, the stimulus which produces one of the three periods needs only to be repeated in order to do away with that condition. From this the following diagram of hypnotic conditions is evolved: —



And, furthermore, Dumont-pallier should be considered as the founder of a series of experiments, for he was the first one to show in a decisive manner that the duality of the cerebral system was proved by these hypnotic phenomena; and his works, as well as those of Messrs. Bérillon and Descourtis, have brought to light the following facts: under hypnotic conditions, the psychical activity of a brain-hemisphere may be suppressed, without nullifying the intellectual activity or consciousness; both hemispheres may be started at the same time in different degrees of activity; and also, when the grade is the same, they may be independently the seat of psychical manifestations which are in their natures entirely different. In close connection with this and with the whole doctrine of hemi-hypnotism, which is founded upon these facts, stands the phenomena of thought-transferrence, which we must consider later.

As an addition to the investigations of Charcot and Dumont-pallier, Dr. Brémaud, in 1884, made the discovery that there was a fourth hypnotic state, 'fascination,' which preceded the three others, and manifested itself by a tendency to muscular contractions, as well as through sensitiveness to hallucination and suggestion, but at the same time left to the subject a full consciousness of his surroundings, and remembrance of what had taken place. Descourtis, in addition, perceived a similar condition in the transition from hypnotic sleep to waking, which he called *délire posthypnotique*, and, instead of using the word 'fascination' to express the opening stage, he substituted 'captation.' According to him, the diagram would be the following: —




This whole movement, which I have tried to sketch, and whose chief peculiarity is that it considers hypnotism a nervous malady, and one that must be treated clinically and nosographically, was opposed in 1880 in two directions, — one source of opposition producing great results, while the other fell to the ground. The latter joined itself to the theory of the Mesmerists, and tried, by means of exact experiments, to measure the fluid emanating from the human body, — an undertaking which gave slight promise of any satisfactory result.

Baillif in his thesis (1878), and Chevillard in his (for spiritualists) very interesting books, tried, by means of various arguments, to uphold the fluidic explanation. Despine also thought that by its help he had been able to explain the phenomena; but it was Barety who, in the year 1881, first turned general attention in this direction. According to him, mankind possesses a nerve-force which emanates from him in different kinds of streams. Those coming from the eyes and fingers produce insensibility to pain, while those generated by the breath cause hypnotic conditions. This nerve-force goes out into the ether, and there obeys the laws that govern light, being broken into spectra, etc.

Claude Perronnet has more lately advanced similar views, and his greatest work is now in press. Frederick W. H. Myers and Edmund Gurney sympathize with these views, and try to unite them with the Mesmerist doctrine of personal influence, and their theory of telepathy. The third champion in England of hypnotism, Prof. Hack Tuke, on the contrary, sympathizes entirely with the Parisian school, only differing from them in that he has experimented with satisfactory results upon healthy subjects. In France this view has lately been accepted by Dr. Bottey, who recognizes the three hypnotic stages in healthy persons, but has observed other phenomena in them, and vehemently opposes the conception of hypnotism as a malady. His excellently written book is particularly commended to those who wish to experiment in the same manner as the French investigator, without using hysterical subjects.

The second counter-current that opposed itself to the French neuropathologists, and produced the most lasting impression, is expressed by the magic word 'suggestion.' A generation ago, Dr. Liébault, the patient investigator and skilful physician, had endeavored to make a remedial use of suggestion in his clinic at Nancy. Charles Richet and others have since referred to it, but Professor Bernheim was the first one to demonstrate its full significance in the realm of hypnotism. According to him, suggestion — that is, the influence of any idea, whether received through the senses or in a hypersensible manner (*suggestion mentale*) — is the key to all hypnotic phenomena. He has not been able in a single case to verify the bodily phenomena of *grandehypnotisme* without finding suggestion the primary cause, and on this account denies the truth of the asserted physical causes.

Bernheim says that when the intense expectance of the subject has produced a compliant condition, a peculiar capacity is developed to change the idea that has been received into an action as well as a great acuteness of acceptation, which together will produce all those phenomena that we should call by the name of 'pathological sleep,' since they are only separable in a gradual way from the ordinary sleep and dream conditions. Bernheim is particularly strenuous that psychology should appear in the foreground of hypnotism, and on this point has been strongly upheld by men like Professors Beaunis and Richet.

The possibility of suggestion in waking conditions, and also a long time after the sleep has passed off (*suggestions posthypnotiques ou suggestions à (longue) échéance*), as well as the remarkable capacity of subjects to change their personality (*changement de la personnalité, objectivation des types*), have been made the subject of careful investigation. The voluntary production of bleeding and stigmata through spiritual influence has been asserted, particularly by Messrs. Tocachon, Bourru, and Burot. The judicial significance of suggestion has been discussed by Professor Liégeois and Dr. Ladame. Professor Pitres in Bordeaux is one of the suggestionists, though differing in many points from the Nancy school.

This whole tendency brings into prominence the psychical influence, while it denies the production of these results from purely physical phenomena, endeavoring to explain them in a different manner. These explanations carry us into two realms, the first of which has been lately opened, and at present seems to abound more in enigmas than in solutions.

*Metallotherapie*, which was called into existence by Dr. Burg, and further extended by Dr. Gellé, contains a special point of interest, — the so-called transferrence in the case of hysterically or hypnotically affected persons. Transferrence is caused by electro-magnetism, which has this peculiarity, — that in the case of specially sensitive persons it can transfer the bodily affection from left to right, and *vice versa*. The transferrence of paralysis, the cures attempted on this plan, and the so-called 'psychical transferrence,' which contains special interest for graphologists, are at the present time still open questions, as well as the closely connected theory of human polarity; and the odic experiments of Dr. Chazarain are yet waiting for their confirmation. At present the problem of the connection between magnetism and hypnotism is under investigation, and in such a manner that we may hope for a speedy solution.

Still stranger than these reports, are the accounts of the distant operation of certain bodies; at least, they seem strange to those unacquainted with psychometry and the literature of the past century relating to this subject. Two physicians in Rochefort, Professors Bourru and Burot, in treating a hystero-epileptic person, found that gold, even when at a distance of fifteen centimetres, produced in him a feeling of unbearable heat. They continued these experiments with great care, and, after a number of trials, came to this conclusion, that in some persons certain substances, even when carefully separated from them by long distance, exercise exactly the same physiological influence as if introduced into their organism. In order to explain these phenomena, they refer to the radiating force of Baréty, an explanation neither satisfactory to themselves nor to others. Lately the distinguished Parisian physician, Dr. Luys, has confirmed by his experiments the existence of these phenomena, but he thinks the explanation referable to hyper-sensitiveness of the "*regions émotives et intellectuelles de l'encephale*," yet even he has not reached the kernel of the difficulty.

In close connection with action at a distance is the question of distant production of hypnotic sleep. For an answer to this problem, they are experimenting in both France and England; and Frederick W. H. Myers has thrown an entirely new light upon the subject by the investigations he is making upon a purely experimental basis. In Italy they have limited themselves to the study of isolated cases of hystero-hypnotism, except as the phenomena of magnetic fascination investigated by Donato have given rise to further research; but all the books I have seen upon this subject, as well as many by French authors, suffer from ignorance of the latest English discoveries.

With this I think that I have given a slight outline of the history of hypnotic investigation to the end of the year 1886. I shall attempt a criticism of this whole movement at some other time, as space is not afforded to me here; but I should like to make this statement now, that two of the characteristic indications of this period are of the gravest import, — first the method ("Our work," says Richet, "is that of strictly scientific *testing, observation* and *arrangement*"); and, secondly, the result. Hypnotism has been received into the realm of scientific investigation, and with this the foundation of a true experimental psychology has been laid. MAX DESSOIR.

## WALCOTT ON THE CAMBRIAN FAUNAS.

IN a recent English geological work there occurs the remark, that, "in spite of the excellent work done by many American geologists, the true se-

quence of their oldest fossiliferous rocks still remains to be determined." The reason of this uncertainty is not far to seek: it lies in the exceedingly complex arrangement of these rocks along the Atlantic seaboard of the United States, where till lately they had alone been studied. Now, however, this reproach is beginning to be taken away from us, and one of the most valuable contributions to the solution of the problem is given by Mr. Walcott in the paper before us.

In the introduction the stratigraphical relations of the Cambrian rocks in Vermont, New York, various parts of Canada, Nevada, Utah, and Arizona, are described and illustrated with sections, and this part of the work is of peculiar interest. The great development of these rocks in the west, and their almost undisturbed position, render them of the utmost importance in deciphering the early history of the continent. Especially is this true of the region of the great Colorado Cañon in Arizona, where is found an immense thickness of unaltered strata which Mr. Walcott considers to be of pre-Cambrian age. The elucidation of its fossils will be awaited with great interest by all biologists as tending to bridge over the great gap between the archean and paleozoic eras.

Mr. Walcott's studies lead him to the same results reached by the English geologists; namely, the division of the early paleozoic series (omitting the supposed pre-Cambrian) into three systems, — the Cambrian, Ordovician (lower Silurian), and Silurian (upper Silurian). On this head Mr. Etheridge remarks, "The recognition of a tripartite grouping of the faunas and strata between the base of the old red sandstone and the Harlech series cannot be disputed: each is characteristic and possesses a broadly marked aspect or facies." In the Cambrian system Mr. Walcott recognizes three series, — a lower, middle, and upper, — which correspond respectively to the St. John's group, the lower and upper Potsdam of Sir William Logan. The lower Cambrian fauna is not known to occur west "of a line passing north-east through eastern Massachusetts, New Brunswick and Newfoundland;" being kept out of the internal basin, Mr. Walcott believes, by a barrier extending from Lake Superior south to Texas, and west to Arizona. The middle Cambrian fauna would seem to be peculiar to America, not being represented in Wales, Scandinavia, or Bohemia: its nearest representative in Europe is on the island of Sardinia. If these results are confirmed, a great advance will be gained.

Most of the paper is taken up with a systematic account of the middle Cambrian fauna of North America, by far the most complete yet given. Forty-two genera (three of them new) and ninety-six species, of which sixteen are new, are fully described and figured. Especially interesting are the curious archeocyathoid sponges, which have so many features recalling certain paleozoic corals, the remarkable primitive pteropods, Hyolithes and its allies, the oldest known cystidean, and the great series of trilobites (fifteen genera). Mr. Walcott has accomplished much with fragmentary material, but the *morphological* results of the study of these early faunas are not very promising.

A gratifying aspect of this paper is its substantial confirmation of Emmons's work on the Taconic system, — a work which must ever excite admiration when its difficulties are considered. "Dr. Emmons deserves great credit for the work that he did. Struggling under adverse circumstances, at a time when there was almost nothing known of the pre-Potsdam strata of North America, and when geologic methods were yet in their beginnings, he accomplished a work in one of the most complicated regions of American geology, the central idea of which . . . we now know to be correct."

It should be remembered that in this paper Mr. Walcott has given a study, and not a complete and final expression of his views. Only a beginning has been made in a great undertaking, but it would be difficult to exaggerate the value of the work already done, which now offers a series of well-defined questions for solution, instead of the chaos which reigned but a few years ago.

*Second contribution to the studies of the Cambrian faunas of North America.* (U.S. geol. surv., bull. No. 30.) Washington, Government. 8°.

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TRICHINAE have been discovered in a human body which was being prepared for anatomical demonstration at the University of Camerino. The man had lived for many years in a neighboring commune, and died without the presence of the trichinae being suspected. Peculiar interest attaches to the case for the reason that it is said to be the first case of trichinosis ever observed in Italy.

— Professor Poncet of Lyons recently had under his care a man whose tibia had been broken and had failed to unite. Between the ends of the broken bone he attached the half of the first joint of a great toe, taken from a limb which had just been amputated. The piece thus attached formed adhesions, at one end fibrous and at the other bony. Whether the bone thus strengthened was of use, the report does not state.

# SCIENCE.

FRIDAY, JUNE 10, 1887.

## *COMMENT AND CRITICISM.*

IT IS NOT OFTEN that the average school board has the temerity to attack or seriously modify the traditional course of study. A capable superintendent or principal who is alive to newly developed needs and conditions will occasionally undertake some reform, but, save in a few of the cities of the country, even that is unusual. It is probably for this reason, as well as because of the importance of the particular case in point, that so much attention has been attracted to the action of the Boston school committee concerning arithmetic. Something over a year ago the following resolution was passed by the committee: "Whereas the study of so-called arithmetic in the grammar schools of this city covers much ground which does not come within the proper scope of arithmetic, which is the art of numbers, no small part of the time and strength of the pupils being given to merely technical application of arithmetical rules; and whereas the exercises prescribed are often difficult beyond the best conditions of mental discipline, the problems set for the pupils being really exercises, not in arithmetic, but in logic, such as pertain to a period of life several years later: resolved that the committee on examinations are requested to inquire and report whether it is not practicable to reduce and simplify the studies and exercises now prescribed under the head of arithmetic."

Afterwards Gen. Francis A. Walker drew up a series of eleven questions, and submitted them to the school principals for the purpose of obtaining specific information, and was fairly successful in the attempt. Twenty-five principals said, that, were the matter left wholly to their own judgment, they would considerably diminish the amount of arithmetic taught; twenty would not diminish it; and five would diminish it slightly. As to the character of the changes desired, there was great diversity of opinion. Thirteen would omit discount, thirteen mensuration, thirteen the metric system, — a most absurd suggestion, in view of the increasing tendency to use this system in scientific books. Nine would do away with compound proportion, eight with exchange, seven with cube root, two with some of partial payments. Thirty-two thought the practice of memorizing the multiplication-table at first injudicious, fourteen considered it advisable, while eight gave a qualified answer. The gist of the conclusions reached is, that the study of arithmetic should be simplified by omitting various specified operations and over-difficult applications of the rest. In fact, the aim of the teacher should be, not to puzzle, but to train the pupil. That this is sound doctrine is certain, but on what application of it the metric system is omitted we fail to see.



SOME TIME AGO we had occasion to commend the action of a committee in excluding from the hall in which a teachers' association was meeting the hawkers of school-journals and school-books. We repeat now what we said then, namely, that while legitimate advertising is both necessary and useful, yet it is out of place when carried on so as to interfere with the proceedings of an association meeting. We recently saw a case in point. At a teachers' meeting not five hundred miles from this city, two agents had established themselves on either side of the main entrance to the hall, and were calling the attention of all who entered to their wares. This, within limits, is perhaps admissible; but during two admirable addresses, one on science-teaching and one on English composition, the noise at the agents' headquarters was so great that the speakers were heard with difficulty. Teachers lingered about the pile of books and papers instead of giving their attention to the exercises for which they had come together. The whole proceeding was discourteous in the extreme to the presiding officer and to the speakers, and ought to have been stopped at once. We have every reason to believe, however, that in the case of this particular association the practice will not occur again.

ON JULY 12 the annual meeting of the National educational association opens at Chicago. Generous arrangements have been made by which teachers can secure transportation and hotel accommodation at low rates, and there is every in-

ducement for teachers to attend the meeting. Perhaps the most valuable feature of the session will be the papers on industrial education, by President Walker of the Massachusetts institute of technology, and by Prof. Felix Adler of New York City, together with the discussions that will follow. But the smallest benefit to be derived from a meeting of this sort is that which comes from listening to papers and discussions. There is the stimulus that comes from seeing and meeting fellow-teachers from all parts of the country, from feeling the sense of professional co-operation. It is this which the teachers of the country most need at present, and it is this which they must have before their profession can occupy the place in the public mind that rightfully belongs to it. It is because of the part that the meeting of the National association plays in bringing about this feeling, that it is chiefly to be commended.

THE SUBJECT of the professional training of teachers is one which will bear all the discussion it can get, and Col. Francis W. Parker of Cook county Normal school, Illinois, Prof. Nelson B. Henry of the University of North Carolina, and Principal William M. Giffin of Newark (N.J.), are peculiarly qualified to write on it. To the student of education, to whom the necessity for such training is so imperative, further argument in its favor may seem useless; but it is surprising how little below the surface these arguments have as yet penetrated. In spite of all that has been so ably said and written on the subject, school boards continue to appoint untrained and incompetent persons to teachers' positions, and untrained persons continue to apply for positions which are as far beyond their capacity as those of a skilled draughtsman or electrician would be to any one ignorant of drawing or electricity. It is for this reason that the point must be unceasingly presented to the public. It must be admitted, too, that the normal schools are not in a true sense professional schools. They combine a large measure of general education with a moderate allowance of professional training. What we want is an institution or institutions that shall be as truly professional as the Harvard medical school or the Columbia law school. If the college to be opened in the autumn in this city by the Industrial education association shall occupy this place, it will contribute largely to put teaching upon a truly professional and scientific basis.

BY THE DEATH of Prof. Thomas Spencer Baynes, which was announced a few days since, the literary and scientific world is deprived of an influential and valuable worker. Professor Baynes's work is not as well known in this country as it ought to be, for the reason that much of his critical thought found expression only in articles and papers published in British magazines or in the proceedings of various associations. Professor Baynes was born in England, not in Scotland as it is sometimes supposed, at Wellington, Somersetshire, on March 24, 1823. He received his early education at the schools of Bath and Bristol, and then went to the University of Edinburgh. He sat at the feet of Sir William Hamilton, and undoubtedly received great mental stimulus from Hamilton's teaching. After taking his degree he became Hamilton's assistant. From 1857 to 1863 he was examiner in philosophy at the University of London, and was also connected with the London *Daily news*, to which he contributed many articles on the American war of the rebellion. In 1864 Mr. Baynes was chosen to fill the chair of logic and metaphysics at St. Andrews. In 1851 he had published his popular translation of the 'Port Royal logic,' which has gone through seven editions. In 1852 appeared his 'New analytic of logical forms,' being a prize essay on Hamilton's logical system, and the best exposition of it that we have. In 1874 Professor Baynes received the degree of LL.D. from the University of Edinburgh, and about that time undertook the preparation of the ninth edition of the 'Encyclopaedia Britannica.' Prof. Robertson Smith has since been associated with him as editor. Professor Baynes's most important contribution to the 'Encyclopaedia' is the article on Shakspeare, which was published in the volume lately issued.

## *DISTILLERY-MILK REPORT. — I.*

IN seeking for information on the use of distillery swill, and its effect on the milk produced by cows to which it was fed, the results were so meagre, that *Science* determined to undertake an inquiry into the subject for itself. With this object in view, the following letter was prepared, and sent to the health officers of all the principal cities, and to the most prominent sanitarians, in the United States and Canada: —

Inasmuch as there appears to be a difference of opinion among sanitarians as to the wholesomeness of distillery waste, or distillery swill, as food

for milch-cows, some believing that milk from animals so fed is not only of poor quality, but actually detrimental to health, and even poisonous to young children, while others regard such milk as simply inferior in quality but not harmful; and inasmuch as the matter is a vital one to the thousands of children in our large cities who depend upon milk as their sole sustenance, — *Science* has deemed it of sufficient public interest to endeavor to obtain and put on record all the facts which bear on the question, and also the opinions of those whose experience and observation have been such as to enable them to express intelligent opinions on the subject. With this end in view, the accompanying questions are sent you, with the request that you will answer them at your early convenience:

1. What opportunities have you had for observing the effect of feeding distillery swill to milch-cows?

2. Please state any facts within your knowledge which will help to determine its effect on the milk.

3. What references can you give to any recorded facts in published or unpublished reports bearing on this subject?

4. What analyses can you give of milk obtained from cows so fed?

5. What is your opinion as to the wholesomeness of distillery swill as food for cows?

6. Are there any laws or ordinances in your city and state which bear on the question? If so, please send copies thereof, or, if this is not convenient, a reference to them.

To this letter many answers have been received. Some of these are from those who state that they have never had any experience with the use of distillery swill or its effects on the milk, while others give the results of the feeding of brewery grains, evidently confounding them with distillery waste, — a subject of great interest, but which is not within the scope of our present inquiry. Still other responses are from those who have had opportunities of investigating the subject and have availed themselves of them, and whose testimony is therefore of great value. In addition to this, letters have been received from physicians and others, who, while having had no practical experience with the article of food in question, are still competent to speak on the subject from their general knowledge. It is our purpose to present this testimony so far as it bears on the matter in hand, and invite criticism from our readers. It may be stated, that, from the information which has come to us, we are justified in assuming that distillery swill is at the present time being fed to milch-cows in the following places: Baltimore, Md.; Blissville, N.Y.; St. Louis, Mo.; Louisville, Ky.; Peoria, Ill.; Philadelphia, Penn.; St. Paul, Minn.; and Toronto, Can.; and up to 1885, in Chicago, Ill. We do not suppose that these include all the places in which this food is used, but no others have been reported. If any of our readers know of other localities, they will confer a favor by sending the information. The first two questions propounded in the circular letter sent out were as follows: 1°, What opportunities have you had for observing the effect of feeding distillery swill to milch-cows? and, 2°, Please state any facts within your knowledge which will help to determine its effect on the milk.

To these the following replies were received: —

[J. L. Hamilton, M.D., Peoria, Ill.]

I have practised medicine in Peoria, Ill., for over thirty years, — a place where more still-slop is manufactured than in any other place in the world, I suppose. For many years most of our dairies fed entirely on swill-slop. The effect on children given only this kind of milk was very noticeable; and when they got sick (as almost all of them did during the summer months), they nearly all died, unless the food was changed. As health officer, a few years ago, at a time when our city was mostly supplied with swill-milk, I visited most of the dairies, and learned the following facts: the calves of cows fed only on swill-feed would live only a short time if allowed only their mothers' milk; that a cow brought to the dairy while with calf invariably lost it, if fed on the slop alone; that cows kept in the dairy and fed only slop would become diseased by the second year, with a skin-disease (large scabs would appear all over them). Some of the cows I examined, and found in this condition; and the dairymen said these cows would soon die if kept in more than two years.

[E. M. Colburn, M.D., also of Peoria, Ill.]

I regret that I am unable to give you any reliable information, from the fact that I have never paid any particular attention to the subject. Peoria has about forty-five thousand inhabitants, is considered a healthy locality, and has probably the largest distilling interest in the United States. Nineteen-twentieths, at least, of our citizens receive their milk-supply from dairies situated from two to five miles in the country, and these all have good bluegrass pastures for their milch-cows. I think (though they deny it) that they all use slops, though only as an auxiliary to other substantial food. The proportion of slops used is so small that the subject has never been investigated here from a sanitary point of view. I have consulted

our city health officer, Dr. Thomas McIlraine, who says, that, having never examined the subject, he has no definite opinion to give; and the same answer is made by several of our leading physicians whom I have consulted. Of course, all our physicians, when treating infants who are fed from the bottle, advise the use of pure country milk from cows not fed upon slops, which is easily obtainable here; and in consequence our experience of the ill or good effects of slop-feeding is very limited.

[NORMAN S. BRIDGE, M.D., Chicago, Ill.]

No special opportunities for observing the effect on the cows; the opportunities of a physician in general practice for observing the effect on the milk. Repeated declarations of families who have had the opportunity of using alternately and at various times milk from country dairies, and from such distillery-fed cows; which declarations are somewhat as follows: that the milk in question sours quicker than other milk; that it has an odor at times that is peculiar to it, which odor is, to some persons, very disagreeable; that the milk disagrees with and makes sick both adults and children. I have observed sick children who were, I had good reason to believe, made sick in this way. The sickness consisted chiefly in disturbances of the alimentary canal and other derangements depending on these.

[L. MCLEAN, M.R.C.V.S., Brooklyn, N.Y.]

I have frequently made post-mortem examinations on the carcasses of such animals. The digestive organs of cows so fed are, as a rule, in an anaemic and atrophied condition.

[D. W. HAND, M.D., St. Paul, Minn., member of state board of health.]

Very limited. Many cows in this vicinity are fed partially on the distillery waste from numerous distilleries, but I have known of no cows fed exclusively on it. I have not been able to notice any detrimental effect on the milk.

[WILLIAM OLDWRIGHT, M.D., Toronto, Can.]

Toronto has, I believe, the largest distillery on this continent, and one would suppose we here should have no difficulty in determining the result of feeding distillery swill; but there are so many other associated circumstances, such as uncleanly surroundings, etc., that it is hard to speak positively. My opinion is, however, that milk obtained from cows so fed is bad.

[E. H. BARTLEY, M.D., Brooklyn, N.Y., chief chemist of board of health.]

Five years as milk-inspector and chemist for Brooklyn health department. Have seen swill fed, and have examined the milk. Have been in active practice, largely among children, during that time, and have watched children fed upon such milk. Have seen two cases of sudden death from swill-milk, which have, I believe, been referred to in articles that appeared in *Science* of May 13. Have seen other cases of indigestion from such milk, which have been cured by change of milk, without medicine.

[WILLIAM K. NEWTON, M.D., Paterson, N.J., state dairy commissioner.]

I have had no personal experience with the feeding of distillery swill, but have always held that it is not only an improper food, but produces unhealthful milk. The fact that the health of cows fed on this substance is soon undermined, and that they become diseased, seems to prove that the milk produced by them must be diseased.

[J. BLAKE WHITE, M.D., New York, N.Y.]

From 1876 to 1886 was chief inspector of milk for the New York board of health. Have paid particular attention to the subject. Have seen hundreds of cows fed on distillery swill, and have noted the effects of such food on the animals' physical condition, as well as on the milk furnished by them. Have made analyses of the milk of swill-fed cows, and also microscopic examinations of same. The milk of swill-fed cows is always of an acid reaction; bluish, watery appearance; sourish, insipid taste; spoils quickly; and has an odor similar to that of the swill. The caseine is very prone to coagulate, and children are very apt to vomit it in large coagulated masses soon after the milk is taken. Analysis shows excess of aqueous element, and great deficiency in the fatty constituent. The globules of fat under the microscope have a great tendency to aggregation, instead of being individually distributed throughout the caseine investment, as in good wholesome milk. The fat-globules are also diminutive and scanty. The cows depreciate in health, are prone to consumption, become emaciated, and ulceration of the mouth, stomach, and bowels occurs; also abscesses of the liver and lungs sometimes occur.

Swill-food hyperstimulates the secretory and excretory organs, causing excessive urination, and consequent disease of the kidneys, diarrhoea and dysentery, and not infrequently degeneration of the mammary gland. Pus is sometimes found in the milk. The natural conditions of the animal's life are in every respect grossly violated by this sort of food, and the necessary consequences are deranged health, loathsome and fatal diseases, which render the secretions diseased, and the milk, *especially*, *unfit* for human sustenance. The

cows are forced, by this method, to become drunkards; and their milk is, without any exaggeration, positively poisonous to infants and very young children. The systems of adults are not so susceptible to the ill effects of such milk; but I am convinced that it is unwholesome, if not immediately poisonous to the human family generally.

Such milk, when given to young children, far from furnishing nourishment, rapidly undermines the constitution, and opens wide the avenue to every prevailing disease, though particularly to diseases of the digestive organs, which often terminate fatally.

Some of the most obstinate forms of cholera-infantum have been directly traced to the milk of cows fed to a great extent on brewers' grains and distillery slop, which latter is the most detrimental.

Language too strong cannot, in my opinion, be used in condemning distillery swill as food for milch-cows, and the severest punishment that the law allows is not adequate for the human brute that would wantonly inflict such cruelty on dumb animals as this method of feeding entails; but most important are the evils which milk from such sources imposes upon human beings, when sold to nourish children, thus polluting at its very source the fountain of life.

[GEORGE H. ROHÉ, M.D., Baltimore, Md.]

None recently. During my early life I had moderately good opportunities, but never observed any ill effects from feeding distillery swill. I may note, however, that swill was not the only food fed to the cows under my observation. They were likewise well stabled, and kept otherwise in fair sanitary condition.

[WILLIAM H. BREWER, professor of agriculture, Sheffield scientific school of Yale college, New Haven, Conn.]

By way of explanation, I may say, that, aside from my profession, I have been a member of our city board of health for about fifteen years, and its president some years, so have given the matter some thought; although there is no distillery here, and, so far as I know, no distillery milk sold in this city.

I wish to add to the notes in this circular, that I have a decided *opinion* that swill-milk is unwholesome; but this opinion is founded on general facts rather than on specific proof.

The following are among the facts inducing this belief: —

1°. That the health of cows affects the wholesomeness of their milk is proven beyond any doubt; and the health of cows fed largely or wholly on distillery swill is poor, as is abundantly shown by their general condition and by their high mortality.

2°. It is well enough known that the food of cows affects their milk, and that their chief food largely determines its character. No one claims that distillery swill is the normal food of cows, or is wholesome food when fed in relatively large quantities. Odors of food (as of onions, etc.) show that some of the chemical compounds of the food go into the milk unchanged; and the same is shown by abundant experiment on animals. The experience with drugs (particularly the alkaloids, as morphine) with women in lactation is in the same direction, and is familiar to all medical men.

3°. When swill-milk is undergoing spontaneous decomposition, it behaves differently from normal milk: it is usually acid when drawn, while normal milk is alkaline; it behaves differently in the processes for the manufacture of butter and cheese (and therefore probably also under the digestive processes), — so differently that creameries and cheese-factories refuse it. This is universal so far as I know any thing about them. I have heard this matter discussed by butter and cheese makers; and, so far as the general facts are concerned, I think there is no difference of opinion, that, where distillery swill forms a large or chief part of the food of the cows, milk is much injured for butter and cheese; the only difference of opinion being as to whether or not some may be used along with other food without injuring the milk.

4°. We have abundant and sad proof that milk readily absorbs infections, and numerous epidemics of disease have been traced to this source. It also absorbs odors, and swill-milk stables are proverbially foul and stinking: so this doubtless adds to the possibilities of unwholesomeness.

5°. These, with other facts taken in their connection, with the scattered and more or less vague data as to sickness in specified cases following the use of swill-milk, where this seems the factor most open to suspicion, — all together make me believe, that, as compared with other milk, swill-milk is unwholesome.

6°. I have never found any facts pointing in the opposite direction. Some are negative, others point in this direction. I know of none that point positively in the opposite.

7°. The use of distillery waste for feeding cows has been more carefully and scientifically investigated in Germany (as I understand it), with the conclusion that it may be used in limited quantities, along with other food which forms the chief part of the ration, without injuring notably the milk. As I understand it, I may compare it

with the use of turnips, cabbage, etc., which make the milk 'taste,' if fed in large quantities or at indiscriminate times, but which may be fed in limited quantities, and at certain times in respect to the milking, without flavoring the milk at all. I have often heard this matter discussed among farmers and milkmen, and, similarly, I think it very probable that *some* distillery swill may be used, regulated as to the quantity, the time of feeding, and the other food which goes with it, without practically injuring the milk. But because of the difficulties of supervising the production of milk for cities, and of controlling its sale, I would forbid, under heavy penalties, the sale of all milk in cities and towns, produced by swill-fed cows, whether much or little swill was used.

I have made many inquiries among physicians on this matter, and I think the vast majority believe that swill-milk is not wholesome for children, and that this unwholesomeness is not merely negative, arising from its poverty in fat, sugar, or total solids, but that it has positively injurious qualities; and that, too, is my own belief.

[HENRY HARTSHORNE, M.D., Philadelphia, Penn.]

Dr. Bispham, a practitioner in the first ward, Philadelphia, tells me that he knows of the use of milk from cows fed with distillery swill, in families under his medical care; and that he has seen evidence that such milk is too stimulating, and unwholesome for children.

[W. SIMON, Ph.D., Baltimore, Md.]

In the spring of 1882 I gave my attention to the feeding of cattle with swill for a number of weeks, visiting the stables belonging to distilleries in and near Baltimore during feeding-time, and drawing samples for analysis. The cattle which came under my examination at the time were fed with plenty of hay and swill only, and were in a good healthy condition, notwithstanding that some of the cows had not left the stable for several months. Neither in quantity nor quality of the milk could I find any abnormal conditions.

[JAMES LAW, M.D., professor of veterinary science, Cornell university.]

Being from home, I cannot profess to answer your questions as to the effects of swill-feeding on milk as I could have done had I been beside my library. I have been accustomed to see brewers' and distillers' grains fed to milch-cows without any noticeable evil effect on the milk. If fresh, these are, in the main, grain robbed of much of its starch and some of its salts. Even when slightly acid from preservation in a closely packed condition, it has not seemed to affect the milk injuriously. It is difficult to see how the same material, ground into a fine farina, and floating in a large amount of water, can be any more injurious, further than as the excess of the water must produce a relative diminution of the solids in the milk. But swill is not always fed in this pure and unchanged condition. As preserved for feeding-purposes, it is often found to have undergone not an acid fermentation only, but even a putrid one as well. In other cases it is alleged that it contains chemical agents of a more or less pernicious nature, that have been introduced with the object of securing a more abundant yield of alcohol from a given measure of grain; and in all such cases the milk cannot fail to be injurious in exact ratio with the baneful nature of the fermentation products, or of the chemicals introduced by the brewer. The question cannot, I think, be settled by a mere general statement of the effects of swill-feeding, but it must have reference to the condition and ingredients of any particular specimen of swill fed. I can easily understand two different observers experimenting at the same time, and reaching diametrically opposite results, because due regard has not been paid to the varying condition of the swill as it was fed, and the different conditions of life of the animals consuming it.

[D. E. SALMON, M.D., chief of Bureau of animal industry, department of agriculture, Washington, D.C.]

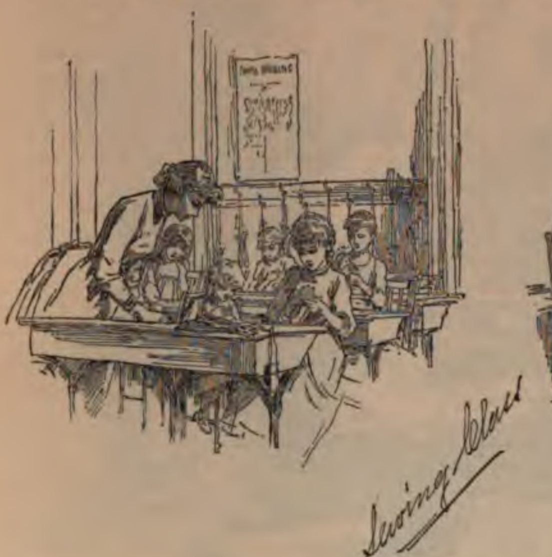
As I have not the exact data at hand which would be needed to answer your questions properly, I prefer to write you a short letter on the subject. In my investigations of animal diseases, I have frequently had occasion to observe the manner in which cows are stabled in sheds where distillery refuse is fed, and I also have quite a clear idea of the way in which the milk is handled. In a general way I have watched the discussions of sanitarians in reference to the wholesomeness of milk produced in this way. In some cases, at least, chemists have reported that milk from cows fed upon swill was equally rich, and, from chemical tests, was as good as, and even better than, milk produced from cows fed upon country pastures. It is extremely doubtful whether such tests as these indicate in any degree the wholesomeness of such milk. From the nature of the food, stables where swill is fed are much more difficult to keep clean, and the milk produced in them is contaminated with more filth and foreign organic matter than ever should be the case in properly kept milk-stables. This would indicate that such milk would undergo changes from the multiplication of microscopic organisms more rapidly than other milk, and that dangerous germs would be more apt to find their way into it. Some sanitarians contend that

the albuminoid constituents of swill-milk coagulate more firmly than in other milk, and that consequently it is much more difficult to digest. I have made no personal observations in regard to this, and therefore can give no personal information of value. The question is certainly an important one, and I hope you will be able to collect information which will clear up some of the disputed points.

*[To be continued.]*

## *THE INDUSTRIAL EDUCATION ASSOCIATION.*

The appearance of the third annual report of the Industrial education association of New York City, and the importance of the work which it





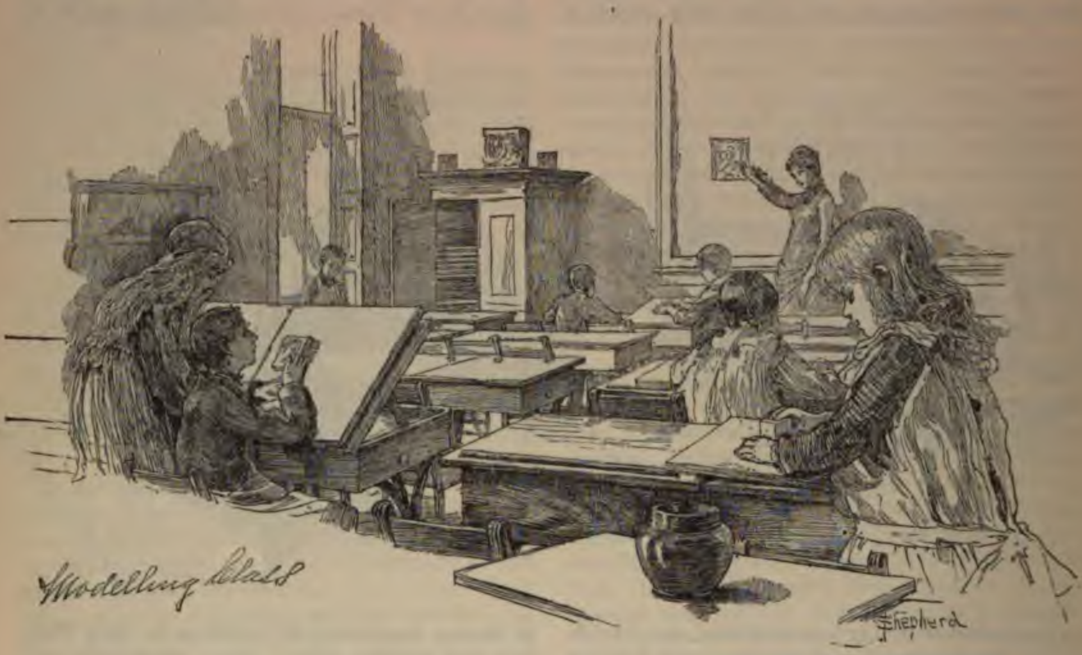
has undertaken and is accomplishing, serve to direct anew the attention of educators and teachers all over the country to a force which is growing mightier week by week, and which is making itself felt as a power for good in our educational system.

The growth of the association's work is a most excellent example of the development of an idea. In April, 1880, there was incorporated in New York City The kitchen-garden association. The objects of this association were the promotion of the domestic industrial arts among the laboring classes, by giving to the children of the same, and to such others as might be deemed desirable, gratuitous instruction in the household arts, according to the principle of the kitchen-garden system; and also to promote a wide and correct diffusion of the principles upon which the system had been founded, and to prevent its degenerating into careless and erratic methods of teaching, which might expose the system to misconception in its objects and operation.

It cannot be claimed that the kitchen-garden system was educational, save indirectly. It was practical philanthropy. The term seems to have originated with Miss Emily Huntington, who published a book on the subject in 1878. By 'kitchen-garden' Miss Huntington denoted an application of some details of Froebel's kindergarten system to domestic service. The association was convinced of the value of the application, and in its first annual report, made in May, 1881, was able to state that during the year the principles of kitchen-garden had been applied in 29 classes, comprising 990 children, in New York City and vicinity alone. Many other cities followed New York's example, and similar classes were reported as existing in Brooklyn, Philadelphia, Boston, Albany, Troy, St. Louis, Cincinnati, Wilkesbarre, Meadville, Newark, Poughkeepsie, Elmira, and Newport. In this initial report the same note is sounded that is heard again in the last report which has just been issued. It is that too much stress cannot be laid upon the importance of training teachers for this work. Persons must not be permitted to take it up without adequate preparation. In thus insisting on a professional training for teachers, the association, in the earliest days of its history, placed itself upon a proper plane, and made its future successful development possible. One year later, in May, 1882, one or two points of advance were chronicled.

The kitchen-garden classes had been continued in all the cities in which they had previously been introduced, and new classes had been established in Orange, Rochester, Yonkers, St. Albans, Cedar Rapids, Germantown, Chestnut Hill, and Cleveland. A normal class had been started, and was meeting with gratifying success. A graduate of the normal class had attempted an extension of the system so that it would suit boys as well as girls. While this extension had not been fully developed, yet progress was reported. The third report, issued in 1883, told of a successful but uneventful year. The fourth report, however, marks a significant stage in the association's development. The board of managers had begun to feel that their present work was too limited, that their fundamental principle admitted of a wider application than it was receiving. This feeling found expression in a resolution passed March 21, 1884, which read as follows: "*Resolved*, that at the next regular meeting of the association the subject of the dissolving of The kitchen-garden association, with a view of re-organizing under a different name and upon a broader basis, be presented, and action taken thereon. It is proposed to make this change, because, first, the title 'Kitchen-garden association' is too limited in its scope; second, experience has proved that a more advanced work in addition is essential; third, it is desirable that industrial training for schools in general, for older pupils, and for boys, be added to the present work; fourth, other systems having been developed, it seems advisable to incorporate them with our own."

In this dissolution the old was not displaced entirely by the new, but it was relegated to a subordinate position. A standing committee on kitchen-garden was provided for, and to it the direction of that work was confided. The result of the re-organization was the Industrial education association. In April, 1885, its first annual report was published; and its whole tenor indicates that a greatly enlarged work had been undertaken. In this report it is stated that the association was organized, first, to obtain and disseminate information upon industrial education, and to stimulate public opinion in its favor; second, to invite co-operation between existing organizations engaged in any form of industrial training; third, to train women and girls in domestic economy, and to promote the training of both sexes in such industries as shall enable those trained to become self-supporting; fourth, to study and devise methods and systems of industrial training, and secure their introduction into schools; also, when expedient, to form special classes and schools for such instruction; fifth, to provide instructors for schools and classes, and, if necessary, to train teachers for this work.



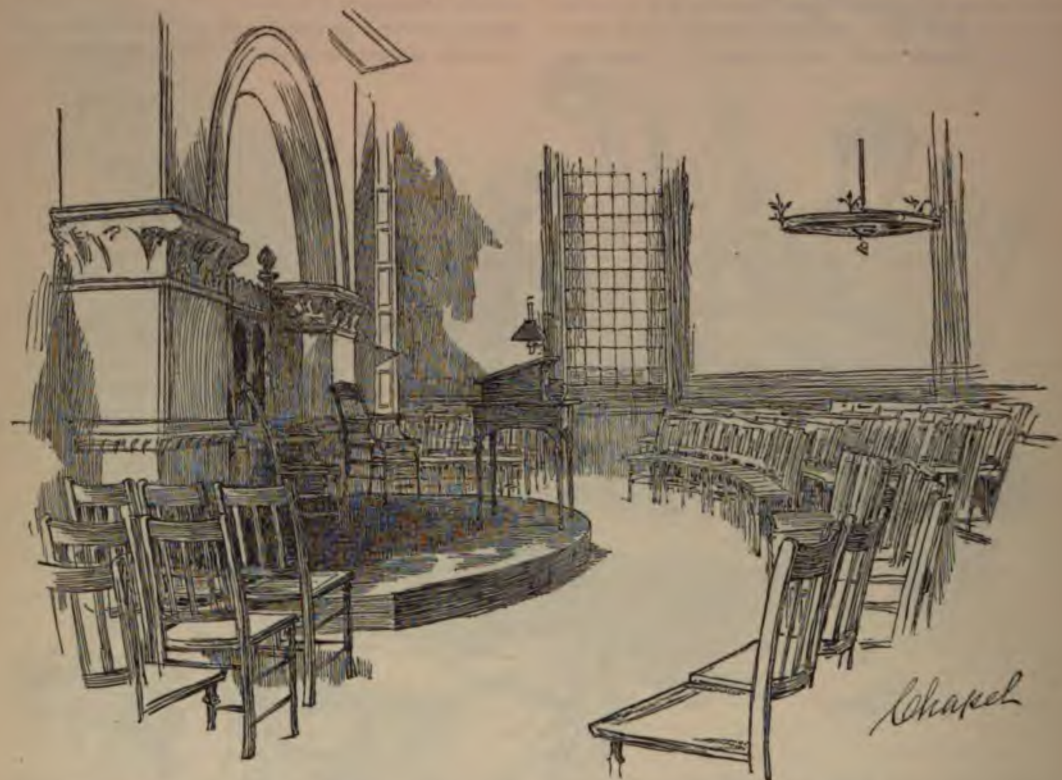

Modelling Class

The work of the year, as might have been ex-

pected, had been largely preparatory. Industrial education had been studied, committees on specific topics organized and set to work. The conclusion had been reached that a centre should be established, where, by practical experiment, the value and feasibility of manual training could be demonstrated. To this end the association had applied to the board of education of New York City for the use of a school-building one afternoon in the week, for the purpose of holding classes after the regular school-hours in sewing, domestic economy, designing, modelling, simple carpentry, and the use of tools. The association offered to assume the entire care and expense, and to open the classes to the inspection of teachers, school trustees, and members of the board of education. This request was refused, and on the quite defensible ground that the board was not authorized to permit the use of a school-building for any educational work not wholly under its own control. During this year, also, Gen. John Eaton, U. S. commissioner of education, invited the association to prepare an exhibit for the New Orleans exposition; but it was deemed inexpedient to attempt any such exhibition at that time.

The second annual report, issued in May, 1886, of the Industrial education association, is somewhat more elaborate than its predecessors. The work of the association had attracted sufficient attention to incur misrepresentation, and it was deemed necessary that an adequate explanation of the term 'industrial' be given. The report insists that by this term is not meant the teaching of any trade, nor the introduction of the teaching of trades into public education. But, the report continues, quoting Mr. Washington Glad-

den, "we hold that there is an industrial training, which is neither technical nor professional, which is calculated to make better men and better citizens of the pupils, no matter what calling they may afterward follow; which affects directly, and in a most salutary manner, the mind and character of the pupil, and which will be of constant service to him through all his life, whether he be wage-worker or trader, teacher or clergyman. The training of the eye and of the hand are important and essential elements in all good education. These elements the state is bound to furnish."




The objects of the association were defined anew, and the more essential of them are, 1°, to secure the introduction of manual training as an important factor in general education, and to promote the training of both sexes in such industries as shall enable those trained to become self-supporting; 2°, to devise methods and systems of industrial training, and to put them into operation in schools and institutions of all grades; 3°, to provide and train teachers for this work.

Numerous classes had been started in various branches of industrial work, and an accomplished and efficient superintendent, Miss H. R. Burns, appointed to organize and develop the work. The special committee on industries had been busy investigating the practical working of the industrial feature wherever introduced into reformatories and similar institutions, and was able to report that three very important conclusions had been reached. These were, 1°, that every child in these institutions should be trained to become a producing factor in the community; 2°, that, if such training is to have permanent value in the after-life of the child, it must be conducted on a basis of education to the child, and cannot be made to any extent a source of revenue to the institution; 3°, that the moral results of such training are most satisfactory.

Perhaps the greatest triumph of the year was the success of the Children's industrial exhibition, held under the auspices of the association. The exhibition was opened on March 31, and lasted one week. To meet the often-expressed wish that this exhibition might show the results attained in cities where industrial education has already gained a definite place in the curriculum of public instruction, special invitations were extended to

New Haven, Jamestown, Chicago, Cleveland, St. Louis, Philadelphia, Boston, Worcester, and other cities. The work of all grades of pupils, irrespective of age, was solicited with a view to showing the results possible under systematic training. To the cordial responses from these cities, as well as to the efficient co-operation of schools and institutions in and near New York, much of the success of the exhibition was due. It comprised no fewer than seventy separate exhibits from schools and institutions, representing the work of thousands of children, and one hundred and forty individual exhibits. This exhibition did a great deal to increase the popular appreciation of the importance of industrial training. The attendance of visitors was very large, numbering over seven thousand persons. The press treated the exhibition with gratifying cordiality.

Great as is the progress noted in the report of 1886, that of 1887 surpasses it. The work had now reached a still more advanced stage. Nearly a year ago the association had outgrown its quarters, and the large building, No. 9 University Place, formerly occupied by Union theological seminary, was leased for a term of years. The building was altered and refitted; and in December last, two classes in drawing, one in carpentry, one in sewing, one in cookery, together with the kindergarten and domestic training department, were in progress. In April this number had increased to seven classes in drawing, six in carpentry, six in sewing, twelve in cookery, together with the kindergarten and domestic training department. The association has had under instruction 4,383 pupils, 2,991 of whom have been members of classes held outside of the building but instructed by teachers in the employ of the association. Over 400 pupils were enrolled in vacation classes held in July and August last. A course of public lectures was given, and attracted much attention. The lecturers were President Gilman of Johns Hopkins university, Superintendents Dutton of New Haven, Balliet of Reading, Calkins of New York, and Barringer of Newark, Col. Francis W. Parker of Cook county Normal school, Illinois, Dr. Henry H. Belfield of Chicago, Dr. Nicholas Murray Butler of Columbia, and Mrs. Mary Dana Hicks of Boston. A museum has been opened — which will be largely augmented in the autumn — which serves as an object-lesson in industrial education. It is always open to visitors, and many teachers and other interested persons visit it daily. From it the eye takes in at a glance the possibilities resulting from the combination of manual and mental exercises, and sees how they supplement and depend upon each other. The museum comprises at present some twelve separate exhibits of drawing, together with specimens of carpentry, joinery, lathe and forge work, representing the Chicago public schools, Worcester high school, Montclair public schools, New Haven public schools, Hebrew technical institute, College of the city of New York, Baltimore manual-training school, Chicago manual-training school, and the Woman's institute of technical design. Still other exhibits are in course of preparation.

A library fund has been secured, and by fall a large reference and circulating library of educational works will be at the disposal of teachers and students. But the most important of the new features is the establishment of a college for the training of teachers. This will open in September, and a circular of information has already been issued. This college will aim eventually to become a professional school for teachers, not a mere normal school in which education and preparation for teaching go hand in hand, but a professional school in the sense that a law-school or a medical college is a professional school. As the law-school has its moot courts and the medical school its dissecting-room, to combine practice with theory, so this college will have its model school.

In this model school the training which the association advocates will be given, — here the new system, which combines the old and the new, will be taught, — and the association hopes to have in it a strong confirmation of the belief which it strives to propagate.

Dr. Nicholas Murray Butler of Columbia has been elected president of the college, and will also hold the professorship of the history and institutes of education. The other positions on the faculty are being rapidly filled, and that professional school which all live teachers have long hoped for will soon open its doors to properly qualified applicants. The college-building, No. 9 University Place, contains a large lecture-hall, in which a series of free lectures will be given. Monographs on educational topics will also be issued from time to time, and several have been already arranged for.

The statement of principles which the Industrial education association issued recently is a most excellent pedagogic creed. It should be carefully perused by every teacher. The substance of it is as follows: —

The association holds, —

1. That the complete development of all the faculties can be reached only through a system of education which combines the training found in the usual course of study with the elements of manual training.

2. That the current system trains the memory

too largely, the reasoning-powers less, the eye and the hand too little.

3. That industrial training, to have its fullest value, must be an integral part of general education. While valuable in some measure alone, it is alone little better than manual training as leading to the learning of trades.

4. That it is not the aim of the association to teach trades. That boys and girls will, if educated according to the system which it advocates, be better able to take up the study of any particular trade, it recognizes as one of the results of the system. It is the development of all the faculties which it holds to be the essential aim of the system.

5. That the fact is generally recognized among those best informed on the subject of education that the kindergarten system produces the best results with young children. The association claims that the system which combines industrial training with the usual and necessary branches is nothing more than a development of the kindergarten theory, — a system found wise for young children modified and adapted to children of more mature growth.

6. That it holds the belief, that as children, wherever found, possess the same faculties and develop the same characteristics, this system should be introduced into all classes and grades of schools, the private as well as the public school, and not alone in the primary public schools, but in all those of more advanced grades.

7. It holds that this system tends to the development of certain moral qualities as well as to the development of the intellectual faculties.

8. That the various occupations which are by this system given to the children, render study less irksome than any system can in which the exercise of the faculty of memory is alone involved.

9. That there exists in this country a widespread disinclination for manual labor which the present system seems powerless to overcome. There is a wide range of occupations which our boys and girls might with advantage enter were it not that they are prevented from doing so by a false view of the dignity of labor. That one of the results of this system of education will be to destroy a prejudice which in a measure arises from a want of familiarity with hand-work.

The accompanying illustrations will give some idea of the way in which the present work is being carried on. In the autumn a marked change will take place, and children will only be found as pupils in the model school. The pupils in the college will be persons preparing for the profession of teaching.

## *NOTES AND NEWS.*

THE annual convocation of the regents of the University of the state of New York will be held at the capitol building, Albany, on Tuesday and Wednesday, July 5 and 6. The papers to be read are, 'The education of the working-classes,' by the Rev. Luke Grace of Niagara university; 'The teaching of mental science in schools,' by Principal Samuel Thurber, Milton, Mass.; 'The study of law as a part of general education,' Prof. F. M. Burdick of Hamilton college; 'Moral training in schools,' Principal Eugene Bouton, New-Paltz normal school; 'The newspaper as an educator,' Regent W. A. Cobb, Lockport, N.Y.; report of committee on necrology, by Assistant Secretary Albert B. Watkins, Ph.D.; 'Private librarian,' by the Rev. Ezekiel Munday, librarian of city library, Syracuse, N.Y.; 'Overcrowding of school courses,' by Principal George A. Bacon of Syracuse high school. Andrew D. White of Cornell university will make an address on Wednesday evening. Thursday will be devoted to conference on the requirements for admission to college between a committee from the associated high-school principals of the state of New York and representatives of the college faculties. The committee from the high-school principals includes Prof. O. D. Robinson, Albany high school; D. O. Barto, Ithaca high school; C. T. R. Smith, Lansingburg academy; Arthur M. Wright, Waterville union school; Henry W. Callahan, Penn Yan academy; D. C. Farr, Glens Falls academy; C. H. Verrill, Delaware literary institute; ex-Principal Noah T. Clark of Canandaigua; H. P. Emerson, Buffalo high school.

— The Wisconsin state superintendent of public schools has done what seems a most excellent thing. A similar custom may prevail elsewhere, but, if so, we have never noticed it. He has issued in pamphlet form all the laws relating to public schools passed at the last session of the state legislature. The pamphlet contains a copy of each law amended as it now reads, and a copy of each additional statute passed at the session of 1887. The plan is an excellent one, and should become general.

— Thomas M. Balliet has been re-elected superintendent of schools of Reading, Penn., for a term of three years.

— The Newark (N.J.) board of education had another acrimonious discussion over Barnes's 'History of the United States.' Although the book was bitterly assailed by some members of the board, it was finally adopted as a text-book in the city schools.

## LETTERS TO THE EDITOR.

***The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### A folk-lore and dialect society.

YOUR editorial comment on the proposition to found a folk-lore and dialect society in this country is, in my opinion, exceedingly opportune. When the American historical association was organized a few years ago, your correspondent and Prof. H. B. Adams exchanged views on the feasibility of establishing such a society as auxiliary to the work of the association. The plan, however, fell to the ground, until, a few weeks ago, a gathering of scholars interested particularly in American folk-lore met at Cambridge, Mass., and formed the nucleus of a promising society for its investigation. The invaluable work accomplished by the English dialect society, and by such publications as *Melusine* in France and Germany, shows what intelligent effort can do in this direction to save from oblivion the relics, linguistic and superstitional, of the past. All philologists know that the study of dialects — dialectology — is of extreme importance to the scientific linguist; for in the dialects are often found archaic pronunciations, idioms, usages, which point to a more ancient time than the pronunciations, idioms, and usages prevalent among those who speak the standard tongue. In this manner, dialect studies in modern Greek, modern Italian, Spanish, and German have contributed abundantly to the explanation of phenomena in those languages otherwise inexplicable. In this country, where dialects were supposed to be non-existent, or to have been obliterated by the levelling influence of the common school, they are really found, on closer inspection, to abound. Noticing this many years ago, the subscriber contributed to the *Baltimore journal of philology* (iii. No. 2) a paper on 'The Creole [negro] patois of Louisiana,' which was part of a plan to embrace studies in 'Greaser Spanish' (Texas, New Mexico, California), 'The Hoosier dialect of the middle states,' 'The cracker dialect of Georgia, East Tennessee, and North Carolina' (as outlined by R. B.), 'Pennsylvania Dutch' (after Holdeman), 'New Englandisms,' and 'Negro English.' The first and last only of this series have been as yet, though very imperfectly, executed. The essay on negro English was about fifty pages octavo in length, and was published in full, as a tolerably complete grammar of negro, in *Anglia* (Leipzig, Germany, 1884). A *résumé* of it was read before the American philological association, which met at New Haven in July, 1885; and a brief abstract of the paper appears among its Proceedings for that year. Negro usage abounds with linguistic curiosities, obsolescent idioms, twists and turns descended from the Elizabethan or Jacobin settlers; and along with these goes a world of quaint superstitions, proverbs, charms, 'saws and sayings,' that reveal a peculiarly naïve and old-world turn of mind and imagination. The Society for psychical research ought certainly to investigate this *terre vierge*, rich with the stratified folk-lore of ages, enamelled with flowers of African parentage, replete with scraps of custom and myth which might throw light on the prehistoric period in the life of nations. A sojourn at the Virginia Springs might open to the attentive folk-lorist of the north, armed with a memorandum-book, stores inexhaustible of southern *mährchen*; for here southern society congregates, conversation is still a fine art, and the long evenings of summer are most provocative of meditative reminiscence. Mr. Gomme's proposed manual for the scientific gathering and classification of all this legendary lore will doubtless prove priceless to such summer sojourners. The south is peculiarly fertile in all the conditions through which the curious beliefs, customs, and narratives you editorially comment upon are handed down from generation to generation; nay, are even generated under our very noses. Let the Folk-lore society and the American dialect society come and gather while the hills are white with harvest. It requires no exceptionally gifted pen to take down what one hears and sees all around one. A series of intelligently articulated circulars, with pregnant hint and clear suggestion, sent out under the auspices of these societies, would doubtless elicit lists of words and descriptions of customs and folk-lore prevalent in particular localities, and these could gradually be elaborated and systematized into a volume. By all means, let these societies go to work without loss of time, and both co-operate to a common end.

JAMES A. HARRISON.

Washington and Lee univ.,
Lexington, Va., June 1.

### The idea of a civil academy.

The idea of a civil academy at Washington, as developed by Dr. Herbert B. Adams, in Circular of information No. 1, 1887, bureau of education, seems to have met with a varying reception from the public press. Condemned by some journals and highly commended by others, the conspicuous attention which it has attracted is the best proof that it is not a mere Utopian dream.

I believe myself that a civil academy is not merely desirable, but that in the no distant future it will be a necessity. The opinions of many government officials who have held positions of administrative responsibility justify this statement. Only recently a gentleman who has long been prominently connected with the public service expressed the conviction that he would yet see the bulk of the higher offices distributed on the basis of competitive merit, in place of being bestowed as the reward of political labors. However this may be, there can hardly be any doubt that civil-service principles have come to stay; and the significance of this fact in the present connection is that a strong demand is thus created for men thoroughly trained and specially fitted, particularly for higher branches of government work. The sentiment has been well expressed by Col. Carroll D. Wright, whose fifteen years of public administrative experience should entitle his views to considerable weight. In an address recently delivered before the joint session of the American historical and Economic associations at Cambridge, on the study of statistics in colleges, he said, "The extension of civil-service principles must become greater and greater, and the varied demands which will be created by their growth logically become more exacting; so that the possibilities within the application of such principles are therefore not ideal, but practical, in their nature. And these

potentialities in the near future will enhance the value of the services of the trained statistician. The consular and diplomatic service, as well as other fields of government administration, come under the same necessity."

One of the objections urged against the civil academy is that we have already plenty of colleges, amply equipped with facilities for political education, — a point which is sufficiently answered by the distinction between 'political science' and 'political praxis.' Political science can be acquired in a tolerably satisfactory manner in many of our institutions of learning, but political praxis is the special product of contact and experience with administrative work. An academy in Washington, with the most favorable environment that could be found, for the prosecution of theorecical studies, and which furnishes contemporaneously the opportunity for apprenticeship work, manifestly embodies the ideal thing.

Without contesting what seems to be a favorite proposition with many journalists, that 'American statesmen come up from the masses,' that they, like poets, are born, not made, it is only fair to add that the country has likewise suffered much from assumed heaven-born genius in high places. This fact we are too apt to lose sight of, and think only of conspicuous examples of statesmanship where the only educational training has been the village school. Is it not true that more statesmen who have come up from the masses have turned out to be incubi to congressional society than glittering lights in the political firmament? No argument can be founded upon the statement before mentioned, for it is certain that no genius would be spoiled by scientific political study; that much might be developed that otherwise would never be utilized.

The strong point of the civil academy is its practical side. Leaving out the disputed question of government aid to higher education, there can be no doubt of the wisdom of expenditure which will create trained and skilful administrators. Colonel Wright says, "The government should supplement college-training with practical administrative instruction, acquired through positive service in its own departments." Statesmen may be born, but administrators must be made. What may be understood as technical training is as much required for them as for the army and navy officer. Whether we will or no, the complexity of modern state life is increasing, is certain to increase still more, and we must prepare to meet the change. I do not think we can check the growth of state interference in matters which were once considered of purely personal and private concern, but we can and must regulate it. How? In two ways, — by multiplying the means for obtaining accurate information upon economic and social conditions, and by basing legislation upon ascertained facts. Congressmen must be able to do more than put themselves 'on record' in favor of labor: they must grasp the true inwardness of the labor-problem in its details. Administrators must not be content with the performance of perfunctory duties: they must be ready, when called upon, to furnish facts suggestive of useful constructive legislation. The training of both must be provided for, and the civil academy offers the combination of advantages to be desired.

E. R. L. GOULD.

Washington, D.C., June 4.

### Sea-sickness.

It is true that many deaf-mutes are known to have enjoyed what seems to be a surprising immunity from sea-sickness; but it cannot be said, that, as a class, they are exempt from the misery we all so much dread.

I travelled last summer on the Pacific Ocean with a number of deaf-mutes, some of whom paid their tribute to Neptune with the best of us who hear.

It is my opinion, however, that there is ground for Dr. James's statement (*Science*, June 3), if care be taken not to say that a deaf-mute cannot be made sea-sick.

If I may say a word from my own experience of a number of ocean-voyages, with a decided tendency to be sea-sick, I think great help may be had by keeping in one's berth at the first approach of rough weather, eating moderately, and not rising until the processes of digestion and assimilation have had time to be quite fully completed after at least two or three meals.

E. M. GALLAUDET.

Kendall Green, Washington, June 4.

### Garbage-disposal.

Your note as to garbage-disposition in Milwaukee does not express the present state of affairs. The health officers of the surrounding towns have forbidden the entrance of garbage-wagons into their districts. At present many plans are under discussion, but none has yet been fixed upon. The furnace plan finds much favor.

ARTHUR STEVENS.

Milwaukee, Wis., June 4.

### Contents of foreign educational periodicals.

*Educational times*, May. — Socrates and his method of teaching. — Meeting of the council of the College of preceptors. — University and college intelligence. — Educational notes and summary. — Correspondence. — The conference of the National union of elementary teachers. — Local colleges for university-teaching. — Lord Hartington on the training of statesmen and citizens. — A teaching university for London. — Recreative evening - schools. — Reviews, notices, etc.

*Zeitschrift für das Realschulwesen*, May. — Logik als Lehrgegenstand an der Realschule, Dr. Anton Ehrenberger. — Beschreibung von Rueprecht's Wage für physikalische Vorlesungsversuche, M. Kuhn. — Schulnachrichten. — Recensionen.

*Educational record*, April. — Editorial notes. — Training-colleges. — Elementary schools. — Books.

### Educational articles in miscellaneous periodicals.

American state and the American man, the. Albert Shaw. *Contemporary review*, May.

Astronomy with an opera-glass. G. P. Serviss. *Popular science monthly*, June.

Books that have helped me. Andrew Lang. *Forum*, June.

Chautauqua; a popular university. J. H. Vincent. *Contemporary review*, May.

Completed work of the federal convention, the. John Fiske. *Atlantic monthly*, June.

Emancipation of women, the. Unsigned. *Westminster review*, May.

Evil of the schools, an. Edward Cary. *Forum*, June.

We call attention to the "Dr. Jaeger Co.'s" advertisement, on our cover page, on the ground of its being a sanitary reform in clothing, which has the endorsement of many of the most prominent members of the medical profession in Europe, and being recommended by many physicians in this country.

It has the sanction, after personal experience, of such authorities as Dr. Stoddard of the "New York Observer"; Dr. Field of the "Evangelist"; Dr. Mallory of the "Churchman," and other editors of the religious press in this city.

# SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 10, 1887.


## *ASPECTS OF EDUCATION.*

### REALISM.

SHELLEY, once writing to Godwin, expressed his surprise that so much time and thought had been given to the teaching of words, and so little to the teaching of things. Under the influence of Sturm and the Jesuits, humanism, or classical education, degenerated into a mere study of words. Little attention was paid to what was said: the chief point was how it was said. Cambridge undergraduates thirty years ago, taught by the most distinguished scholar in the university, when they read a Greek play or a Latin poem, heard little about the plot, or the allusions or their relations to modern writings of the same kind. Attention was exclusively paid to readings, to the delicate variations in the meanings of words, to grammatical forms, to letters and accents; yet the teacher was a man full of love of English and other literatures, and steeped in the knowledge of them. The best scholars turned out of the university were surprised to find, as a result of their training, how little they knew of the literary masterpieces, which they had spent a great portion of their lives in learning to construe. The main aspects of ancient life were entirely unknown to them, unless accident had led them to learn them. Yet the teaching of things rather than words had been advocated by great educationalists, both abroad and in England.

The typical realist in education is Comenius. His whole life was devoted to the improvement of educational methods. He was one of the first to appeal to the eye as an instrument of instruction; but his most important work was the 'Great didactics,' a complete treatise on the art of education. The central idea of this book was that the education of every man should follow his natural growth. Take the whole circle of sciences with which the mature man can be acquainted, — arithmetic, geometry, astronomy, ethics, politics, and many others, — what are these but names for departments of knowledge, which the human mind creates for itself? If we take away from them their repulsive appellations, and consider them in their simplest elements, we find that they are nothing but what the child learns from its earliest infancy. 'Metaphysics' is a hard word, yet what is it except the science of ideas as apprehended by the mind? A child four years old was once lying in bed, recovering from an illness, when its father and mother came to the bedside. The child described the feeling it had in its leg. The father said, "That is pins and needles." The child thought to itself, "How can my father make so rash a statement? What he means, expressed in accurate language, is, that what I am describing sounds to him as the sensation which, if he felt, he would call pins and needles; yet how can he tell that the sensation which I am now feeling is the same as that which he denotes by that name?" There was present to the child's mind the whole problem of the relativity of knowledge, yet that has sometimes been found hard even for men to grasp. In the same way, what is the knowledge of natural phenomena, such as fire, rain, and snow, but the knowledge of physics? What is the ability to find his way about his own village but the rudiments of geography? What are his family annals but the beginnings of history? The government of the household would teach him domestic economy, the administration of his native town would teach him politics, the rules of simple behavior would teach him ethics: take away the bugbear of repulsive nomenclature, and you will find every science can be studied in its simplest elements from the beginning of life. Comenius regarded the sciences which were accessible to human knowledge as an ever-widening circle, to be learned by child, boy, and man in the measure for which their strength is adapted. When it is possible in this way, by following the course of nature itself, to arrive at the knowledge of every thing that is worth knowing, why should we confine the growing mind in the trammel of mere language? From the mother's school the child would pass to the national school; one existing in every house, the other in every parish. From this he will go, as years advance, to the gymnasium, which is to be found in every large town; and thence, if strength admits, to the university, which exists in every province.

The didactic theories of Comenius met with a strange fate. His manhood was nearly coincident with the thirty-years' war, which made educational experiments impossible in Germany. He came to England just as the civil war was breaking out. That did not prevent his proposals from

attracting the attention of the parliament; and they would have given him for his experiments some large college, either in town or country, had not political troubles made it impossible to do so. He was taken up by the Protestant powers of Europe, partly because they represented the greater spirit of progress, and partly because they were opposed to the exaggerated humanism of the Catholics. Had he lived a hundred years earlier, the effect of his teaching would have been far more powerful. Had Comenius, instead of Melanchthon, been the preceptor of Germany, Catholics and Protestants might have been divided in education, as they were in religion, but the world would have been enriched by a training of wider scope and greater possibilities. Thwarted by the political troubles of his time, his teaching never arrived at its full development, and had little effect upon the world until it received a new shape at the hands of Pestalozzi and Froebel.

The learning of things instead of words found a powerful advocate in England in the person of John Milton. His 'Tractate on education' is one of the most gorgeous dreams of a complete training ever conceived and elaborated by an educational theorist. He admits that it is right to learn the languages of those people who have at any time been most industrious after wisdom, but he asserts that language is only the instrument which conveys to us things useful to be known. "Though a linguist," he says, "should pride himself to have all the tongues that Babel cleft the world into, yet, if he have not studied the solid things in them as well as the words in lexicons, he were not so much to be esteemed a learned man as any yeoman or tradesman, competently wise in his mother dialect only." He defines a complete and generous education as that which fits a man to perform justly, skilfully, and magnanimously all the offices, both private and public, of peace and war. The Latin language, taught with the Italian pronunciation, is to lay the foundation of good morality, "infusing into their young breasts such an ingenuous and noble ardor as would not fail to make many of them renowned and matchless men." Varro and Columella are to teach, not only Latin, but agriculture, — how to recover the bad soil and to know the waste that is made of good. Aristotle and Pliny are to give instruction in science. Mathematics, comprising arithmetic, geometry, astronomy, and trigonometry, have a separate course of their own, from which progress is to be made to fortification, architecture, engineering, and navigation. Theoretical studies in these and other similar branches are to be supplemented by practical training given by experts in the several pursuits. Not until this broad foundation of theory and practice has been laid are the pupils to read the works of those poets who treat of country lore. The next stage is to lay the foundations of philosophy and ethics, the knowledge of virtue and the hatred of vice. Plato, Xenophon, Cicero, Plutarch, are to be read, not for their language only, but for the ethical teaching which they contain. After ethics succeeds rhetoric, to form the tongue and the imagination of the future orator. Italian is used to give a soft and melodious pronunciation; Greek and Latin tragedies, with the humanists the food of school-boys, are reserved for the completion of the rhetorician's art. To this succeeds the study of politics, learned from the great masters of law from Moses to Justinian, continued down to the laws of our own constitution. Sundays are now to be spent in the higher branches of theology, and the scriptures are to be read in their original tongues. Not till now comes the study of history and poetry, mixed with a certain amount of logic; and then, and not till then, are the scholars permitted to write for themselves. Original composition, instead of being, as among the Jesuits, the principal mental discipline even of young children, is to be reserved until the mind has been thoroughly penetrated both with matter and with manner.

A large portion of the proposed training is devoted to exercise. "In those vernal seasons of the year," says the poet, "when the air is calm and bracing, it were an injury and sullenness against nature not to go out and see her riches and partake in her rejoicing with heaven and earth. At this time the pupils might ride out with prudent and staid guides to all places of strength and commodities of building, and of soil for towns and tillage, harbors and ports for trade." Milton, in this vision of the future, does not intend to sketch a scheme of popular education, but one suited for select pupils and select teachers. It is strange that the advice of one who was himself a schoolmaster should have been so much neglected by the brothers of his profession. This may be explained by the fact that Milton wrote for an age in which Latin was the universal language, the common means of communication between scholars. The troubles of the seventeenth century left little room for the application of his theories; and, when society had become sufficiently settled to adopt them, Latin had lost its place in the world of learning, and the standard of humanism had been raised aloft by the Jesuits.

The establishment of realism as an integral part of education is due to the French revolution, and it is inseparable from the name of Pestalozzi. There could not be a greater contrast than be-

tween Milton and Pestalozzi. Milton's educational scheme was derived, on the one hand from his poetical imagination, and on the other from his scorn for the shallowness and frivolity of some of the statesmen with whom he lived. Pestalozzi learned the principles of his art in the care of poor orphans and in the hard experience of his own checkered life. Milton's plan, like that of Plato, was adapted for a select number of rulers. Pestalozzi's plan was framed for the benefit of very little children, and has only been gradually seen to be applicable to all departments of education. In the year 1798 the village of Stanz, near the lake of Lucerne in Switzerland, was burned by the French, and a great part of the inhabitants murdered, because they would not receive the constitution offered to them by the directory of Paris. The children who escaped the slaughter were left homeless and orphans, and Pestalozzi was asked to take care of them. He established himself in a large deserted convent, deprived of all means of sustenance. He lived with the children by day, and slept with them by night, sharing the poor food which could be got together for their common support. It was by this close contact with the child-mind that Pestalozzi, almost himself a child, learned some of the deepest secrets of education. No traveller should look down from the Rhigi upon the valley where Stanz lies, without reverencing it as the birthplace of educational ideas which are destined to revolutionize our system of training. Yet when I rang, a few years ago, at the convent-gate, the good sister of charity who opened the door for me had never heard of the name of Pestalozzi, and knew nothing of the great Christian work which had been carried on within her walls. The central idea of Pestalozzi was to train the mind through the senses. Humanism, dealing with words alone, had depended mainly upon the memory. Children learned long lists of Latin and Greek nouns, long rules of Latin and Greek construction. Pestalozzi had no books. One of his best materials for instruction was an old piece of tapestry embroidered with animals. The children were taught to see, to touch, to taste, to smell, and to report exactly what their senses had taught them. By ingenious methods the first simple operations of the senses were made to lead insensibly to the higher operations of the mind. Milton had recommended that the rudiments of mathematics should be taught playing, as the old manner was. Pestalozzi made this plan a reality. Pestalozzi taught us to make the fullest use of a keen observation of young children, of their quick apprehension of what immediately surrounds them, and of their surprising power of retaining what really interests them. He also taught us to follow, in the most loving and even servile manner, the growth of each child's mind, and of the child-mind as a whole. Yet it cannot be said that he was very successful as a practical teacher, and many who have posed as his disciples have been great failures. To force children by compulsion to learn many things by heart is the easiest, and it is also the most stupid and the most unfruitful, method of education. To follow the growth of their minds, and to adapt the training at each instant to their needs, require the patience of a saint and the insight of a philosopher, and these qualities are seldom found.

Frőebel may be regarded as one who has worked out with great minuteness and success a particular part of Pestalozzi's teaching. The kindergarten system, as it is called, rests upon the assumption that the senses of a child are to be first dealt with, and that it is by their means that the intelligence can be best aroused. Froebel, starting with the care of very young children, was able to reduce their education to something like a system. They are taught by degrees to see clearly form and color; to imitate them in various ways; to distinguish by the touch hard and soft, cold and hot; to train their ears to delicate sounds, and their mouths to refined and expressive speech. Their restlessness is utilized for social drill and dances. A child is encouraged to imitate just what he understands, and no more. It is impossible to see a kindergarten class, even when composed of the youngest gutter children, without feeling that this must in time be recognized as the only fit education for the infant-mind.

But it is a mistake to suppose that the principles of Froebel are applicable only to the training of very young children. It is as natural for the brain to grow and to exert itself as it is for the arms and legs to stretch themselves. Our inherited traditional methods of education are too often the swaddling-clothes of the mind, which impede its growth rather than assist its development. In schools higher than the kindergarten we have yet to learn that pleasure is a far more potent instrument of training than pain. Many teachers value lessons for their very harshness and repulsiveness, and take no pains that the mind should pass easily from the known to the unknown with ever-growing delight and satisfaction. Far too much stress is laid on mere memory. Memory depends on interest. Children will recollect accurately whatever has deeply roused them at any time. If we secure interest, memory will follow of itself. Again: schools spend far too much time on a set course of study. Pestalozzi and Froebel learned all they knew by the

slavish following of the growing mind. It is probable that in no two minds do the faculties develop in precisely the same order. That curriculum is best which is adapted to the greatest number of minds, but no curriculum could be adapted to all minds. Just in proportion as the course of study laid down in school is rigid and unalterable, so far will it fail to reach a large number of those for whom it is intended. Just as, in elementary education, payment by results is opposed to the whole spirit of Pestalozzi's and Froebel's teaching, so in our higher education we cannot obtain the highest level of instruction unless we assign a lower place to examinations.

There is no fear that in the present day realistic education — the learning of things instead of words — will be neglected. There may, indeed, be a danger lest we should teach things which are not the best worth learning, lest we should waste on mechanical arts or on the lower branches of science powers which ought to be applied to the highest products of the human mind. Gœthe tells us that Wilhelm Meister, a dreamy enthusiast, took his son Felix to be taught in the Paedagogic Province. On returning a year afterwards to see how he was getting on, he could not at first find him; but, as he was in an open field, he saw in the distance a cloud of dust. The dust developed into a troop of horses; and out of this troop galloped the young Felix, riding a white bare-backed steed, from which he threw himself and fell at his father's feet. The rulers of the Province explained, that, having tried Felix at every thing else, they found that he was most fit for breaking horses, and therefore set him that task. We now see Goethe's dream realized, not only in technical education, but in the schools which are growing up over England for the training of young colonists. A boy is taken at fourteen, and taught how to build a house, to make his furniture, to manage a farm, to navigate a boat. This is realistic education with a vengeance; and the same might be said of mere technical training, where it does not rest upon the basis of general culture. Yet the extravagances to which this side of education may run are slight, compared with those which have for so many years formed the bane of humanism. Some exaggeration is required to redress the balance. It is difficult to secure improvements in education, and it is almost impossible to revolutionize an educational system. Educational theorists write as if a single child, willing to be taught every thing, were dealt with by a teacher able to impart every thing. The reality is very different. Children are taught, not singly, but in masses; and in a crowd the standard of conduct is generally that of the worst rather than that of the best. To secure all the attention of a large number of children needs considerable gifts, and to force a large class into active co-operation with the instructor is what few teachers can do. Again: a small proportion only of teachers have any special gifts of insight, liveliness, or imagination. They can only carry out the methods in which they have been trained. Once more every traditional system is protected by a large number of means and appliances for study which have grown up under its reign. The very perfection of the school-books makes it easier to study classical literatures and Greek and Roman history than any similar department of more modern date. The passive resistance of pupils, the absence of useful aids, the want of enterprise in teachers, — all militate against the substitution of a rational education, such as Comenius would have given, for the complete and elaborate drill in the arts of expression which we owe to Sturm and the Jesuits. America has been less spoiled than Europe by the influence of petty traditions; and it is there, perhaps, that we may look for the rise of a training which will begin with the kindergarten, will be inspired in its higher branches by the enthusiasm of Milton, will always pierce through the veil of words to the substance which the words are intended to convey, and, while training to the full the senses of the individual and his mechanical powers, will not fail to set the highest value on the best products of the human mind, and will never, in the pursuit of material science, undervalue the far dearer treasures of poetry and philosophy.

OSCAR BROWNING.

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## *TRAINING OF TEACHERS.*

THE history of our normal schools is the inside history of the progress of education in the United States. Established by prolonged struggles, maintained by continual contests, they have been the central point of onward movement. Circumstances have made them, at the best, but half-measures for the training of teachers. State normal schools are excellent high schools, and a little more. The general standard of admission is that of graduation from grammar schools, eight or nine years' course. Two years are spent in regular high-school studies; the third year a partial course in pedagogics and methods is begun; and the fourth year, psychology, pedagogics, methods, and practice form the principal work. Compare this with preparation for other professions, — four years high school, four years college, and then the law, medicine, or theological school. Rarely can a pupil study psychology with any profit until the

high-school course is finished. Very few pupils can grasp the laws of mind until they are more than twenty years of age. Without psychology, any comprehension of the science of education is impossible. Without this science, imitation of methods is the only resort. One in ten or twenty by inherited and acquired power may have the strength to understand principles: such graduates go on with their studies, and make efficient teachers.

The need of the hour is the establishment of purely professional training-schools, — schools that would take rank with the best law and medical schools. The normal schools themselves suffer greatly for lack of strong, broadly educated, professionally trained heads. A principal of a New England academy, without a spark of professional training, goes into a great western territory to take charge of a normal school, and help lay the foundations of the educational system in a new state. In another profession he would be called a quack: in ours it is almost a necessity, because trained efficient teachers, capable of taking the lead in education, are exceedingly scarce. Few superintendents and principals have had any training for their work. A graduate of Harvard or Yale is just as well fitted to enter the pulpit, the law, or to heal the body, as he is to take the head of a school. In some large cities — Boston, for instance, which has one of the best training-schools in the country — many women teachers know far more of the science of education than their principals.

There is a crying need of safe leaders in education. There never was in our history comparatively a tithe of the earnestness, enthusiasm, and general awakening in the cause of education, as there is at present. This vast energy is spending, and will continue to spend itself in the superficial study of methods, devices, and general details of management and organization, unless there are means offered for a far deeper and broader study of the laws of human growth and the principles of teaching which spring from them.

The present normal schools, struggle as they may and do, cannot well grow into the needed purely professional schools. The rural districts look upon them as convenient, cheap, and good high schools; and rural legislators will continue to hold them to that line of work: the normal element must necessarily be secondary.

Let New York or Pennsylvania, for instance, found one professional training-school. Find a head first, — a very difficult task. Give the principal two or three excellent assistants. Take a whole village or small city for a practice department. Admit upon a rigorous examination only graduates of colleges, normal schools, and high schools, of full four years' courses; admit, too, teachers who have made themselves efficient by three years of successful teaching. Make the school the central point and place of meeting of the county superintendents. Allow them to spend all the time they can command in study at the school. The course is indicated by the term 'professional training-school.' History of education, psychology, pedagogics, and methods should make up the curriculum.

Any teacher or superintendent, of whatever age or standing, could go to such a school with no sense of degradation, just as De Garmo and Seeley went to Stoy's famous Lehr Seminar at Halle. If Stanford could be induced to found, with his proposed university in California, a school like the one outlined above, he would confer upon his fellow-men a priceless boon. Rich men are constantly giving immense sums to sectarian schools, technical schools, academies, and colleges. Oh that some rich man would die for a professional training-school for teachers!

FRANCIS W. PARKER.

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I. There are many who see no necessity for such training. A knowledge of the subjects to be taught is thought all-sufficient. But the time when the ignorance and vice of the teachers made them an article of public vendue,[1] or when they followed teaching because they were fit for nothing else, is a thing of the past. A great school system has been built up; the masses of the people are more enlightened, and they demand qualified workmen, though they may not, and in many instances do not, understand the need of professional schools in which to train these workmen. Nor is this demand for competent teachers unreasonable. Better qualifications for any business or profession are required now than were required fifty years ago. We have training-schools for nurses, for cooks, for clerks, for the trades, for farmers, as well as those for the learned professions. The medical student, even after his graduation, feels that his preparation for the practice of medicine has not been completed, and that the people are not yet willing to trust him. Nobody doubts that he has learned the facts necessary to be known; but he has yet to learn to use these facts, to do which he places himself under the special training of a competent teacher, — enters into partnership with a successful practitioner. The lawyer and the clergyman often pursue the same course. People do not question the wisdom of such policy. They commend it, be-

[1] See Report of commissioner of education for 1875, p. xx.

cause they realize that to know a thing is altogether different from being able to do it. Why should the teacher be an exception to a course so commendatory to the good sense of the people? Certainly it is not because the mind of the child is esteemed of less worth than his body or his estate. He, also, must have this training.

II. But of what shall it consist? Not simply of a knowledge of the facts to be taught, nor even, in addition to this, a knowledge of how to teach. Many a one who cannot teach, knows how. School officers ought to know how teaching should be done, but it is not at all necessary that they should be able to do it. Of far greater value than professional knowledge is professional ability. Mere theoretical teaching does not give the power to act. This power comes only from acting. It is true that the young teacher may acquire it in the school-room, and the practice, though often very painful to him, is exceedingly valuable; but the multiplicity of failures to every successful experiment makes it very hard upon the school. Instruction in the matter to be taught, and in the methods of teaching it, should be accompanied by practice in teaching. Nor should this practice at first be in a model or practice school, but in classes whose pupils have already developed their modes of thinking, and formed their habits of study and recitation under the instruction of superior teachers. Little harm beyond the waste of time can come to them from the misdirected efforts of the young teacher; but such would not be the result of his efforts in the ordinary model school composed of little children. During his senior year in the training-school, the young teacher should spend one hour a day in the practice-school, teaching under the direction of his professor, applying the theories he has learned. Not only this: as soon as he enters the training-school, he should be required to examine every question from the stand-point of the teacher as well as from that of the pupil. In every recitation he should play, in some important respects, the *rôle* of teacher. The object of professional training is to enable the teacher to use his knowledge. This it can hope to do successfully only as it gives him exercise in using knowledge, under the direction of an experienced teacher. NELSON B. HENRY.

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THE professional training of teachers has become a necessity in all of our large cities; and the time is not far distant when the same will be true in every city, town, village, and district. There is no longer any doubt but that teaching is a service, hence there is no longer any reason why the teacher should any longer be subjected to little petty 'quiz' examinations every few weeks in order to retain his position. Fix the standard of scholarship high; and when one has credentials from any well-known authority, accept it. On the other hand, however, see to it that those who are to train the immortal souls of our children know the difference between the instinct of a dog and the human mind. Too many teachers teach a human being the rules of arithmetic by exactly the same method they would teach a dog to 'speak' for a piece of bread and butter, or a parrot to ask for a cracker. As well might a lawyer endeavor to practise law with no knowledge of the statute laws of his state, or a doctor to practise medicine with no knowledge of physiology, as a teacher to practise the profession of teaching with no knowledge of the mind he is trying to shape.

The teacher who has no knowledge of child-nature should make this his first study; for the man or woman who has forgotten how he or she felt as a child, is hardly calculated to teach. Certainly no such person is fit to be the disciplinarian of children.

A person trying to be a teacher, with no knowledge of the principles of psychology, is like a little tug-boat pulling and tugging and puffing with might and main to get the 'pupil' in the right place; while those who go at their work understandingly take the place of the rudder, and guide the pupils in the right direction to help themselves through.

Let not those who are engaged in the professional training of teachers think their work all done when they have filled their pupils with theories. As well might they lecture on the art and science of swimming, and at the end of six months cast their pupils off the Brooklyn bridge to swim ashore, and expect them to do it, as to expect such pupils to do good work in the school-room.

The practice must go hand in hand with the theory. No student in a medical college can receive his diploma until he has passed a certain number of weeks in the dissecting-room. Neither should a student of psychology receive his diploma until he has had a number of weeks' experience in the class-room. We sometimes think it a pity that the mistakes of the pupil-teachers in the class room do not, like those of the student of medicine in the dissecting-room, fall back upon themselves, and not upon their innocent little subjects. Were this the case, thousands of mistakes that have been made would have been avoided.

We often hear it said that teaching school belittles a man and sours a woman. To this we take exception, and say that it is the 'narrow

school-keeper' that belittles the school. The true, high-minded, hard-working, untiring, conscientious, progressive, enthusiastic, God-fearing teacher never belittles the school, society, or himself, but raises the standard of each.

Perhaps before closing we should explain one of those adjectives, viz., 'enthusiastic.'

We certainly think the professional teacher should be enthusiastic; because those who accomplish the most good are those who have energy and enthusiasm, and show by their work that they are in earnest, and believe what they do to be worth doing well. There is a difference, however, between a demonstrative and an enthusiastic manner. To be *noisy*, *flighty*, or *fussy* is not to be animated. Animation or enthusiasm is earnestness without undue excitement. WILLIAM M. GIFFIN.

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## *INDUSTRIAL TRAINING IN THE PUBLIC SCHOOLS OF GERMANY.*

MY observations on the industrial training of the public schools of Germany are chiefly confined to the city of Darmstadt, the capital of the grand-duchy of Hesse-Darmstadt.

For many years the court of this grand-duchy of Hesse has drawn to the capital the representatives of the best education and culture; and its school system is undoubtedly the fairest model in central Germany.

Besides its common public schools, the city contains a polytechnic school, a gymnasium, a realschule, a school for the higher education of girls, several private schools, and a number of kindergartens.

To the noble efforts of the much-lamented Princess Alice may be largely attributed the interest that, since her death, has been taken throughout Germany in industrial training for girls. As soon as Princess Alice came to Darmstadt, she made her influence felt. The Alicen-Verein was organized with the princess as president, and Fräulein Louise Büchner as vice-president. This Verein is an association of women, whose object is to impart instruction in the various duties of housekeeping to mothers and their daughters, and to encourage them to better morals and habits of life, and inspire them with a higher ideal of w. Tomanhoodhis association started an entirely new and popular interest in girls' hand-work, — that kind of industrial training for girls which is now one of the regular branches taught in all the public schools of Germany.

In a country like Germany, with a dense population and with a sharp competition in all the departments of labor, with enfeebled natural resources, the only temporal salvation for the masses is work, — patient, continuous, and remunerative manual labor. Now, when this work is performed by an educated and skilful hand, it is plain that its effectiveness is enormously increased. The boy who has received industrial training is more apt to learn a trade; he is better prepared, as the masses must be in all countries, to make a living with his hands; he will be a happier man, more contented, and less willing to leave his fatherland and emigrate to foreign lands. These are undoubtedly some of the strongest reasons why the German government shows such a solicitude for the industrial training of its youth. At Darmstadt, a few years ago, several private citizens made an experiment in giving industrial instruction to boys after school-hours. The results of the experiment were such convincing proofs of the needs of such instruction in every city, that the institution was incorporated, and became a branch of the public-school system, although no special provision had been made in the school law, such as had been made for the industrial training of girls.

The manual-training schools are intended for that class of boys — and a very large class it is in every city — that idle away their time before and after school on the street, where they learn more readily the vices of the depraved than the virtues of the good, and so counteract whatever of honesty, patience, perseverance, kindness, and obedience the teacher at school may attempt to inculcate. This is the reason why the boys in our country, as well as in Germany, who have to work before and after school, make the best progress in their studies, and are the most obedient, and give least trouble to the teacher at school.

In Germany the schools close the daily session at about 2.30. After this time, the boys who, either through poverty or the indifference of parents, are not properly and healthfully employed, must attend the industrial school for the rest of the day. In the industrial school at Darmstadt, in the summer-time, the boys are put to work in the different gardens belonging to the institution. They are divided into classes or companies, each under the supervision of a teacher. One day I saw a company of boys, about twenty in number, between the ages of nine and ten, engaged at transplanting cabbage-plants, and for the first time in my life did I discover that there is an intelligent way of doing work even as trifling as this seems to be. In another part of the garden a company of older boys was preparing the ground for a new crop: the work was likewise systematically and even scientifically performed. In other

parts some were weeding, some were watering plants; others gathered fruit and vegetables, and prepared them for the market. The flower-garden is the most interesting part to the stranger. Here I saw a company of boys laying out ornamental flower-beds. Beauty, taste, and skill, coming from such young hands, fill the stranger with admiration.

At other seasons of the year the boys are engaged at various light crafts in work-rooms, such as the making of baskets, brushes, brooms, etc.; light and plain carpentry, where the use of tools is taught. The hammer and saw are the principal tools for the younger class: with these they are taught to drive nails and saw boards at various angles. Type-setting and book-binding are taught to the advanced and older classes.

Each boy receives a small remuneration for his work when it is faithfully and obediently performed. The money, however, is not directly paid to him, but is put into a savings bank for him; and from time to time he receives his certificates of deposits, which the boy, with a face all aglow with inexpressible delight, carries home to his parents for safe keeping.

As the industrial training of boys requires grounds, extra buildings, tools and appliances, and in many cases extra teachers, it can only be indirectly connected with the public schools. And although the government encourages manual training for boys, there are great difficulties in the way of making it universally obligatory. For this reason it is not mentioned in the school law as one of the regular branches to be taught in the public schools, but must be left entirely to private and municipal efforts, with indirect aid from the government. But girls' manual training, or, as it is called in Germany, 'female hand-work,' presents none of these difficulties; so that it finds a place in the school law. The following is a translation of article 12, p. 6, of the school law of the grand-duchy of Hesse: "The following are the branches to be taught in the common public schools: religion, reading and writing, composition and grammar of the German language, arithmetic, mensuration, history, geography, natural history, vocal music, drawing, gymnastics for the boys, and for the girls instruction in female hand-work."

Female hand-work, however, is no new thing in the public schools. From the very earliest times of school history, girls have been known to take their knitting and sewing to school; and in our country, in the early part of this century, not only the girls, but the boys also, used to knit their own stockings at school. But the work then performed had no educational end in view. The industries were yet undeveloped, and every family was obliged to manufacture its own clothing. Each member of the family had to lend a helping hand, so that the work done at school seems to have been performed through necessity.

This is not the case with the hand-work performed in the schools in Germany now. Its purpose is purely an educational one, — to train the hand, and develop its cunning. And to guard against selfish and calculating tendencies, the pupil is not permitted to make any thing to be worn by any one; for nothing is more mischievous, and more directly opposed to the harmonious development of a child's mental powers, than a calculating motive, — the motive whose chief outlook is material gain. This manual training is pursued for its own sake, as a mental and ethical discipline, and by no means for its economic value.

The parent furnishes the child with the needed material, which, when the child has finished its course, may be as useless as the paper upon which it has written its language-exercises. And yet, for all this, no one complains that it does not pay. The benefits of industrial training are best understood by the authors of school law. From another page of the school law I make the following translation: "Female hand-work is not only to have a practical purpose, bearing upon the proper management of a home, but it must also tend to train girls early to habits of usefulness, and to develop the virtues of endurance, patience, industry, economy, and benevolence, and to refine the taste for order and for becomingness in dress."

The instruction is based upon philosophic principles, and is imparted in a systematic manner. None others but teachers who have taken a thorough course in the industrial-training schools for female teachers are permitted to teach at all; and when you enter a room, no matter whether it be the lowest primary or the highest grammar, you will find a teacher there who understands her business thoroughly.

Two to three hours each week are given to industrial training, generally on Tuesday and Thursday afternoons.

Knitting is the first exercise, and the ordinary forms of meshes are continued throughout the seventh year. Sewing is next introduced.

Among the first lessons in sewing are the use of the thimble and scissors, threading the needle, and the ways of holding the cloth while sewing and cutting; a lesson is also given upon the different kinds of thread. The stitch-lesson is first performed on paper: after a while, a cheap kind of muslin is substituted. Every lesson is made a class drill. The children work by dictation: all

in the room do the same work at the same time. Every new mesh or stitch that is introduced is first illustrated by the teacher before the class, on a frame which is high enough for all to see. It is rectangular, two feet by eighteen inches. Heavy threads or cords are drawn through its sides, crossing each other at right angles. After the seventh year, crocheting of loose, open, and close meshes, with one-colored yarn, is introduced. Next party-colored yarn is used, from which various beautiful figures are made, which gradually leads them to crochet articles of many beautiful patterns.

From the twelfth to the fourteenth year (the last year in the public schools), sewing is the chief branch. The patching and mending of torn garments is most thoroughly taught. In the last school-year the cutting and making of underwear is taught.

The specimens of work that come from those young hands are simply wonderful in points of neatness, skill, and taste. Any generous-minded person will be at once convinced that the capacity for happiness in those young girls is far superior to that of the class who have never been taught any thing else than mere book-knowledge.

SEBASTIAN THOMAS.

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## THE TEACHING OF ALGEBRA.

AMONG the papers lately presented to the Education society of London, is one on the teaching of algebra, by W. H. H. Hudson. It contains a great many passages of universal application, and such deserve to be reproduced in this country for the benefit of our teachers of mathematics. Mr. Hudson first answers the question, Why teach algebra at all? and, while fully recognizing the utility of algebra, he maintains that algebra is not to be taught on account of its utility, nor to be learnt on account of any benefit which may be supposed to be got from it, but because it is a part of mathematical truth, and no one ought to be wholly alien from that important department of human knowledge.

The next question is, When should algebra be taught? The answer is, At an early period of intellectual development. The reason for this is that algebra is a certain science, it proceeds from unimpeachable axioms, and its conclusions are logically developed from them: it has its own special difficulties, but they are not those of weighing in the balance conflicting probable evidence which requires the stronger powers of a maturer mind. It is possible for the student to plant each step firmly before proceeding to the next; nothing is left hazy or in doubt: thus it strengthens the mind, and enables it better to master studies of a different nature that are presented to it later. Mathematics give power, vigor, strength, to the mind. This is commonly given as the reason for studying them. This is also the reason for studying algebra early, that is to say, for beginning to study it early. It is not necessary, it is not even possible, to finish the study of algebra before commencing another. On the other hand, it is not necessary to be always teaching algebra: what elementary teachers have to do is to guide pupils to learn enough to leave the door open for further progress; to take them over the threshold, but not into the innermost sanctuary.

Children younger than nine will rarely be fitted to take up algebra; and, on the other hand, it is seldom advisable to defer its commencement until after twelve years of age. Certain preliminary acquisitions are essential for this study. The first of these, in Mr. Hudson's opinion, is the power of listening.

"By this I mean the habit of attaching an idea to what is said. Some pupils — I hope no teachers — consider it sufficient if the pupil can reproduce the words that have been used, without attaching any idea to them. Such pupils will not learn algebra. A pupil who has the habit of listening will not allow a teacher to use unintelligible language, and will be of great use in a class by stopping the teacher and asking for things to be repeated and strange words explained. It is difficult for a teacher to realize that sometimes he is using a vocabulary beyond his pupils. Interruptions of this kind, which show that the pupils are listening, are of great help to the teacher.

"This leads to the next essential preliminary: the student should be able to speak. I do not mean that a deaf-and-dumb person cannot learn algebra, but he can only be taught under great disadvantages. Thinking of the ordinary run of boys and girls, I say that they cannot learn algebra until they have learnt to speak. By speak, I mean can ask questions and can answer questions, can say what they know, and can point out what to them is obscure. It has been well said that a pupil who cannot ask a question in his natural voice is unteachable: my own experience confirms this. Some pupils put on a lecture voice, in which they answer questions put to them. I do not call this speaking. It is unnatural and artificial, and is a serious bar to progress. It arises from timidity, fear of the teacher, or fear of the rest of the class; and the latter is far more difficult to be got rid of than the former.

"Moreover, a pupil must have a sufficient command of language to be able to frame a complete sentence. I have heard of teachers who are satis-

fied with a single word as an answer, and who habitually put their questions so as to admit of such an answer. This does not encourage the art of speaking in the pupil; in fact, it destroys it, and is not to be commended.

"A third preliminary is the power of reading: this is far more difficult, and far more usually absent, than the preceding. Many a boy who can listen and speak has no idea of reading. He can, it is true, form the sounds appropriate to the words he sees, but he has not the habit of using a book as a mine of information, of reading in order to get the sense: his main idea too frequently is that of learning the sound of the words, like a parrot.

"There are few more valuable lessons that can be given to a boy than to teach him to read a book, and extract the sense out of it. This is what young children naturally do with their fairy-tales; but when they become school-boys and school-girls, their natural reading seems somehow to give place to a mechanical lesson-reading.

"Now, mathematical reading differs from most other reading in this: that it requires writing. This is the fourth essential preliminary. It is possible, no doubt, for a great genius to carry on all the steps of a piece of algebraical reasoning in his head. The ordinary school-boy cannot do this, cannot pass from one statement of the book to the next without inserting an intermediate step. The boy who has learnt to write, who always, while reading, has a piece of paper and pencil at hand to work out details as they arise, will learn algebra: the one who tries merely to remember the words and symbols of the book will make no real progress.

"These preliminaries of listening, speaking, reading, writing, do not properly come under the head of teaching algebra: they are so obviously essential, that I scarcely need have mentioned them, but in so many cases absent, that I implore those who have the early training of children not to lose sight of them in the vain hope that without them any progress in higher studies is possible.

"Another essential preliminary more distinctly bears on the subject. The teaching of algebra must be based on, and naturally arises out of, a sound knowledge of the principles of arithmetic. In return, the knowledge of algebra will enable a student concisely to express these principles, and to understand them more clearly. On this account, it is necessary that those who undertake the teaching of arithmetic should have a sufficient knowledge of algebra. This is another lower reason for studying algebra; namely, in order to be able to teach arithmetic.

"It is a mistake to teach a pupil any thing that he has subsequently to unlearn; the persistence of first impressions is notorious, therefore arithmetic should not be taught in such a way that it needs correction when algebra is studied. The two are naturally and historically connected; and one who is wholly ignorant of either is apt, also, to be unfamiliar with the other. The teacher should be above his subject, not in the sense of despising it, but as one who looks from a height upon a plain can see the topography of the country more distinctly than one on the lower land.

"Therefore, in the interest of algebra, I protest against the practice of despising arithmetic, of setting it to be taught in schools by persons ignorant of algebra, and, it may be, contemptuous of the subject they have to teach. A teacher of algebra ought to find the ground prepared for him by a sound knowledge of arithmetic; and it would be better, therefore, that the mathematical masters should undertake arithmetic.

"This leads to the next question, Who are to teach algebra? It may, perhaps, be thought by some that a teacher requires to be very little ahead of his pupil, and that one who has slight knowledge is good enough to teach a beginner. On the contrary, the proper teaching of the elements of any subject requires a teacher who has a knowledge considerably in advance. I do not hesitate to say that it would be well that a teacher of algebra should know something — and that something soundly — of the method of co-ordinate geometry, of trigonometry, and of the differential calculus. Teaching should be anticipatory. The algebra taught should be such as to prepare for these higher subjects, and this can only be effectually done by one who is acquainted with them. Moreover, the elementary teaching requires more care and more knowledge than more advanced. Nothing is worse than to lay foundations imperfectly. A necessary qualification for a teacher of algebra is, therefore, a sound knowledge of mathematics considerably in advance of the subject he is teaching.

"Next let us ask, How is algebra to be taught? It is fashionable nowadays, and I do not say it is a bad fashion, to attach importance to the training of teachers in methods of teaching. But I think too much importance can be attached to method. Methods that seem good, and are good when first introduced, seem to lose their virtue after a few years. An energetic teacher will be constantly changing his methods, and adapting them to the various characters of his pupils. Freshness and vigor are far more important qualities. Nevertheless, an unmethodical teacher, who would do very well for a single pupil, is incapable

of conducting a large class. My own personal predilections are in favor of a Socratic system of teaching, by asking questions, and so drawing out, — educating, — the mind of the pupil. I do not regard it as good to tell the pupil every thing. It is our object to train him to exercise his own powers. A child who is always carried will never learn to walk. But a child who can walk cannot get over a stile, and requires a lift now and then. It is a matter of tact to decide, in any particular case, whether the assistance is to be given or withheld. I do not feel competent to lay down general rules. With a pupil who can listen and speak, understanding these words as I have explained them, there is little difficulty in ascertaining whether the supposed inability to proceed arises from want of power or from laziness. It very often arises from want of will, not exactly a downright shirking of work, but a certain deficiency in determination. In such cases a guiding hand is better than a lift.

"That method of teaching is best which most stimulates the mental activity of the pupil, and that is the reason why methods after a time cease to be good: it is just because they are methods, and become mechanical, and so fail to stimulate activity.

"Algebra should be taught as if to an intelligent person. Unfortunately, all the pupils in a class are not equally intelligent. Still, people turn out very much as you treat them: draw out the germ of intelligence, and it will grow. A style of teaching that is based on the supposition that the class is unintelligent, is apt to end in making them so. To this end no slovenly work should be allowed. It is a mistake to look only at the answers of a set of exercises, and not to care about the orderly setting forth of the argument that leads to the answer. This is a practical detail that requires some skill to adjust: the mode of adjustment depends on the size and character of the class. Too much of the teacher's energy is in danger of being absorbed in examining exercises. The benefit of the exercise consists chiefly in doing it, and in so doing it that it needs no subsequent alteration: consequently the correctness of the answer is a most important point. But a practice of merely looking at the answer allows the boys to fall into slovenly habits, and may lead them into the unsound habit of working up to an answer.

"Considerable difference of opinion is expressed as to just how the first steps in algebra should be taken. It may be taken by using letters as general symbols for numbers, treating algebra as a generalized arithmetic; and there is much to be said in favor of this. In this way algebra presents itself as a language, and this is a view of algebra that ought to be put before the student at an early period. Some of the most instructive of the early exercises in algebra consist in translating general arithmetical statements into symbolic language, and in forming the equations which are the algebraical statement of problems. Simple equation problems can hardly be begun too early.

"On the other hand, the notion of the negative number can be acquired without the use of any fresh apparatus of symbols beyond those that the student has been accustomed to in arithmetic: and, as this is one of the greatest of the early difficulties of algebra, I have sometimes thought it wise to begin with it, so that the difficulty of the negative quantity may be mastered without the complication which the use of letters seems to give to the matter. I think myself that it is more logical to begin with the letters, but that it is, on the whole, easier for the student to begin with the negative quantity. To talk about and explain $5-8$ is simpler to a beginner than the use of $a$ and $b$.

"But, whatever sequence of the parts of the subject is adopted in teaching, there should be no departure from a logical development. Algebra is built up on certain few axioms, and certain not very numerous conventions. A pupil should be led to see from the first the distinction between what is axiomatic and what is conventional; though, in the latter case, he may be unable, at an early stage, to see the convenience of the convention: he is not a sufficient judge of this, in many cases, till his studies have proceeded much further. But he should be encouraged to see for himself that the propositions of the science are correctly deduced by means of the axioms of which he admits the truth, and no matter should be taught which cannot thus be put before him.

"The gradual extension of meaning which such a term as 'multiplication' receives — first in arithmetic, when it is extended to a fractional multiplier; then in algebra, when the multiplier is likely to be negative; and finally in applied mathematics, when we contemplate a concrete multiplier — is a matter which should form part of the teaching of algebra to all, who should thus be led to see that in mathematics 'impossible' is a word of only temporary significance. A student who knows only arithmetic is justified in saying that $5-8$ is impossible; but the impossibility is a stile to be gotten over.

"In looking over exercises, it is often more important to look over those that are wrong than those that are right. When an example has been done right, correct in reasoning and accurate in

process, the teacher may look at it to see where the form might have been improved, how it might have been curtailed, what steps were superfluous, and so on. So long as any fault in reasoning has to be corrected, it is premature to examine inelegancies. I do not advise correcting too many mistakes at once. It disheartens a pupil to have too many faults found at once. One mistake in each example is ordinarily enough. The faults of reasoning are to be first corrected, then mistakes in work, and, last of all, mere matters of arrangement. I know that this order is distasteful to some pupils, who like first to be told how to put their work down. I recommend the other order: let them first reason out the proposition in the way which they can follow by themselves, and make no mistake about it; then they are able to appreciate the advantage of particular modifications of their process that a more experienced mathematician may suggest to them.

"As an example of what I mean, I may refer to division by a binomial factor, such as $x - a$. A pupil will at first naturally imitate long division in arithmetic; he may then be shown how the abbreviated, or synthetic method, as it is called, is a mere re-arrangement and curtailment of what he has done before; whereas, if he had been taught the shorter method as a rule from the first, it would have been a mere un-understood rule of thumb.

"It has been for a long time my practice, due to a hint from the late Mr. Todhunter, always to require to see an attempt and an exact statement of his difficulty from a pupil, of any problem that he says he is unable to solve, and which appears to me to be within his reach. The reason is, first, that I may see where the precise difficulty is, and so know what it is that I have to explain; and, still more, because in the act of setting forth the difficulty the obscurity has a habit of disappearing. A student may think he is unable to solve a problem because he cannot see his way from the beginning to the end; but he can generally draw some conclusion from the data of the question. I can then give him just the help he needs, whereas otherwise I am liable to explain to him what he really understands, not knowing what it is that stops him.

"The influence of examinations is not wholly bad, as at first sight one might be tempted to think. A teacher who has not the prospect of an examination of his pupils before him is apt to think that it is sufficient if his pupils understand the subject, and that requiring them to reproduce it is superfluous. In this they are liable to lose the great advantage which the necessity of writing out would have given them, and the teacher is extremely likely to credit them with a knowledge that the examination would have shown that they do not possess. As a test of knowledge, then, an examination is useful; nay, it is most valuable. But when the examination is made an end in itself, and when the object aimed at is to produce a semblance of knowledge to deceive an examiner, where the reproduction is made a primary object instead of a secondary one, in subservience to the mental education, then the influence of the examination is mischievous.

"However intelligent and teachable a pupil may be, he will occasionally make mistakes. The commonest forms of these annoying but comparatively innocent mistakes are miscopying either the question or their own work, arithmetical slips, and mistakes with the signs + and —. These mistakes do not always imply ignorance or inattention, and a teacher is unwise to attach too much importance to them: a few of them are quite consistent with a sound appreciation of principle. The effort should be made to undermine the causes of these faults, rather than to correct them when made. The chief of them is hurry. This is a growth of our age which sends down the fibres of its rootlets even to the minutest arrangements of school-life. Set before your pupils that accuracy is preferable to pace; accustom them to the habit of exact speaking and writing, even to the dotting of i's and crossing of t's, — and such faults will largely disappear."

## THE STUDY OF LANGUAGE.

HUMAN language is wholly a psychological process. As von Humboldt long ago pointed out, it is nothing innate, but a function; it is no concrete object, but exists only in the soul of the indi-

*Die praktische Spracherlernung auf Grund der Psychologie und der Physiologie der Sprache.* Von FELIX FRANKE. Heilbronn, 1884.

'Sprachentwickelung, Spracherlernung, Sprachbildung,' von F. TECHMER, in *Dreizehnter Bericht über die höhere Schule für Mädchen zu Leipzig.* Leipzig, 1885.

'On the practical study of language,' by H. SWEET, M.A., in *Transactions of the Philological society,* 1882-84. [The President's annual address for 1884.] London, Trübner, 1885.

*Der Sprachunterricht muss umkehren! Ein Beitrag zur Ueberbürdungsfrage von Quousque Tandem* (Wilhelm Vietor). Zweite um ein Vorwort vermehrte Auflage. Heilbronn, 1886.

'Techmer's und Sweet's Vorschlage zur Reform des Unterrichts im Englische,' von H. KLINGHARDT, in *Englische Studien,* band x., heft i. Heilbronn, 1886.

*German pronunciation: practice and theory.* By WILHELM VIETOR. Heilbronn, 1885.

*Elemente der Phonetik und Orthoepie des Deutschen, Englischen, und Französichen mit Rücksicht auf die Bedürfnisse der Lehrpraxis.* 2d ed. Von WILHELM VIETOR. Heilbronn, 1887.

vidual. In the same way, the language of the individual is to be defined as a psychological activity associated with movements of the organs of speech, — its physiological side. Every individual has his own language, as he has his own ideas; and from analogous causes, as each nation has its own manner of ideal conception, so it expresses the same in its own peculiar way, and also finds different sounds for the physiological form. To learn a foreign language is, accordingly, not merely to acquire a foreign vocabulary whereby to translate one's preconceived notions, but it is to penetrate into a foreign mode of thought which alone is capable of suggesting its own individual form of expression. As Techmer asserts, "He who, in any case, will speak rationally, must think. He who will learn to speak in a particular language, be it English or Chinese, must learn to think in that language."

All language goes back to associations of the perceptions awakened by the different properties of objects. Out of these associations, at first unconscious, in the course of time, are developed conscious, apperceptive associations in series, combinations, and organized systems. These, in their turn, may serve as centres from which are developed the combinations of human speech, — those of form (inflections, etc.) as well as those of meaning (synonymes, etc.). Upon the mass of unconscious associations thus formed depends the practical command of language; on the conscious, apperceptive, and systematic associations, on the other hand, is based the theoretical knowledge of language. It is to be borne in mind that all associations at first conscious through practice acquire the property of working unconsciously. In accordance with what has been said, language-study, then, may be of two kinds. It may be, on the one hand, in order to attain the practical command of a language, that is, we may seek the language as the form of thought; or, on the other hand, it may be to acquire a theoretical knowledge of language, in which case the language becomes the subject of thought. A child, at the outset, learns language only as the form of thought. The development of consciousness is almost identical with the acquisition of language; or, otherwise stated, idea and word are to all intents and purposes acquired conjointly. Later on, the child learns language through language itself, and not only with the ear, but with all the organs of sense. Every new perception finds an expression in language to describe it; and the idea resulting from the perception is so associated with the word, that the word immediately reproduces the idea, and the idea the word. It is also to be noticed that the formulation of rules of language through the tracing of analogy is taking place unconsciously; that learning the language is proceeding within the boundaries of the language itself; and that the acquisition of the spoken language is the only end in view. One principle, originally formulated by Preyer in 'Die Seele des Kindes,' is of importance for its application elsewhere: the healthy child understands spoken language much sooner than it can itself produce by imitation the sounds, syllables, and words that have been heard. Furthermore, only what is interesting and intelligible to the child is firmly impressed upon its mind: all else is in a short time forgotten. Further to be remarked is the fact that the forms of expression learned by the child are simple, unaffected, and idiomatic.

The problem presented in learning a foreign language for practical use is how to obtain, with the least possible expenditure of time and energy, such a complete mastery of the mechanism of the language that it will, as in the case of one's native speech, unconsciously accompany thought, and become its form. That the case as thus stated has its difficulties becomes at once apparent. In the first place, we can have neither the time nor the opportunity to hear or to speak the foreign language that we had in the case of our own. And even if we have, on the one hand, the advantage of being able to think and to reason, and the knowledge of one language system already acquired, it implies, on the other hand, a direct disadvantage: the native language holds fast our thoughts, between which and their forms of expression there is such an intimate union that it will be found difficult at first to make room for new ones. The organs of speech, again, have been accustomed, through constant repetition, to produce without conscious exertion one system of sounds, which the ear through constant hearing has grown able to differentiate with the utmost sharpness. The foreign sounds, on the contrary, produced on an entirely different basis, are not readily differentiated by the ear, and are only to be imitated by careful practice.

A. H. Sayce, several years ago, in an article in *Nature*,[1] wrote, "Our present system of teaching languages . . . is based rather upon empirical haphazard than on scientific principles." The remark is as applicable as ever. In spite of the progress made in recent years in our knowledge of the fundamental laws of language, and particularly of its phonetics, but little has been done, except in isolated cases, to apply in practice what has been scientifically established beyond all question. While all else has advanced, language-instruction has been content to stand still, notwith-

[1] *Nature*, May 29, 1879.

standing the important position already assigned it among the recognized essentials of education. The striking inefficiency of the old method of teaching foreign languages has been proved year after year by barrenness of result; but nevertheless, if popular text-books are a criterion, language is still taught in the same old way. An attempt is made to learn it only consciously, and letters and the literary language are falsely regarded as synonymous with sounds and the spoken language. Worse than all, with the old method of translation, the foreign language has been studied within the native language; and, while foreign words and forms have indeed been taught, no attempt has been made to teach or to learn with the foreign language the foreign mode of thought.

It is Sayce, again, who affirms axiomatically that language consists of sounds, and not of letters. Sweet, too, insists no less strikingly that language-study is concerned not with dead letters, but with living speech. It is accordingly the spoken form of every language that should form the basis of its study, which should furthermore proceed from the stand-point of the sentence, and not from that of the word. Upon these fundamental points all recent writers on the study of language are substantially agreed. With one exception, the writers cited above would, however, eliminate from the question the factor which I have called the theoretical knowledge of language, and would make its practical command the one end in view. Techmer alone regards the practical acquisition of a language of primary importance, but would base upon it theoretical study with the idea of making the knowledge of the new language more perfect and firmly fixed. What is here of less weight from its bearing on the subject is his characterization of this theoretical study of language as "an educational means of bringing the harmonious and homogeneous development of the mind to its highest possible perfection." The true place which the theoretical study of language should hold is best of all stated by Storm, in his 'Englische Philologie' (Heilbronn, 1881). He would neither eliminate it entirely, on the one hand, nor would he give it undue prominence, on the other. The theoretical, he maintains, is practical in a higher sense, because it facilitates the comprehension and acquisition of the facts.

The pronunciation of a foreign language should form the first stage of its instruction, and this can only be taught on the basis of scientific phonetics. Whether the instruction should proceed at the outset through the medium of phonetic transcription, is a point upon which not all writers are agreed. Techmer, in the light of his own experience, is against it. Sweet is outspoken in favor of it: he would entirely discard the ordinary orthography, and substitute for it one purely phonetic; and in this dictum he is followed by many others. Vietor has practically applied this theory to German for English learners in his 'German pronunciation,' which is worthy of a wider distribution than it has thus far had in this country: even if it is found impracticable to use it in its entirety as a text-book in the class-room, its material will prove of the utmost value for the wealth of suggestion that it contains. Unproductive as is our whole present system of language-teaching, this matter of pronunciation, which recent writers on the subject almost with one voice maintain should be a foundation principle, is, nevertheless, the weakest element of all. The ordinary text-book gives at the beginning a few pages on pronunciation, unscientific in character, and consequently imperfect and inexact, and utterly inadequate even with constant and painstaking iteration, as every teacher knows, to convey the information desired. In learning the sounds of a foreign language, the course to be followed is from simple sounds to syllables, to words, and finally to sentences. With words and sentences, meanings are also to be associated: such sentences should, further, be the natural sentences of language, which are precisely the ones that cannot be constructed *a priori*. There is no place in language-instruction for Ollendorffian sentences like "The merchant is swimming with the gardener's son, but the Dutchman has the gun."

When the foreign sounds and sound-complexes have once been thoroughly mastered, and not until then, a reading-book, containing connected texts written in the simplest and most colloquial style, and embodying as few infrequent words and phrases as possible, is to form the main foundation for the study of the new language. Sweet expresses himself most definitely as to the arrangement of such a book. It should have, first, descriptions of nature and natural phenomena, of the different races of men, their dwellings, food, and dress, because the elementary vocabulary of material things, phenomena, and actions, is most easily embodied in descriptions of this character; narrative pieces come next; and, lastly, idiomatic dialogues, and longer pieces which combine all three elements. These texts should be, it is hardly necessary to state, both interesting and entertaining, in order perfectly to fulfil their purpose. At the end of this stage of the instruction the learner will have an easy command of a vocabulary, not wide, it may be, in range, but thoroughly prac-

tical in character, and adequate to express the most necessary ideas. The next stage is to consist of condensed treatises on special subjects, such as history, geography, and natural science, after which the learner may gradually choose his texts with increasing freedom, until he is finally able to read the actual literature of the language itself in its original form.

The reading of texts, however, is not the only element of instruction: during this whole time the systematic study of grammar, idioms, and vocabulary is to accompany and run parallel with the reading. As to the true position of grammar in the study of language, there is but one mind. It should be studied immediately in connection with the texts, and, furthermore, inductively. Sweet puts it best of all when he says that "grammar, which is merely a commentary on the facts of language, must follow, not precede, the facts themselves, as presented in sentences and connected texts." But neither he nor the others mean that its systematic study should be deferred longer than the stage when the learner is able to master phonetically the sentences that are given to him. Klinghardt expressly states, that, in his opinion, a purely inductive method of teaching grammar is only suitable at the very beginning, — a dictum in which all practical teachers will concur. Later on, a short grammar, to be learned systematically, should be placed in the hands of the pupil. It should include, however, nothing that is not required for the explanation of the texts, and every rule should have its example. Still later the advanced student might be given a reference-grammar, which should contain all rules.

Vocabulary may be studied with regard to the meanings of words either analytically or synthetically: that is, the word 'good,' for instance, may be taken through its various meanings, — 'pleasant to the taste,' 'useful,' 'morally good,' etc.; or else the idea, for instance, of 'morally good,' may be taken, and the various words and phrases by which it is expressed, like 'virtue,' 'bad,' 'vice,' may be enumerated. The synthetic method thus includes the whole vocabulary of a language. Word-lists are on no account to be studied. Connected sentences, as already stated, should be the medium of instruction. A word has already been said in regard to the study of idioms. Only necessary idioms should at first be taught. For conversational purposes, questions are more necessary than answers; the former, then, should be mastered perfectly, while the latter require merely to be understood.

In the system here elaborated no place is provided for the old mechanical translation method or the grammar calculated to accompany it. A reading knowledge of a language may doubtless be obtained at the expense of a great deal of labor and time by translating foreign texts. The direct benefit, however, of such a process, is to increase one's own native vocabulary and command of language, — a result, no doubt, admirable in its way, but exactly the reverse of the end desired. A greater evil still arises from giving a learner the literature of a language, be it modern or classical, before he knows its vocabulary and grammar. "What," Sweet pertinently inquires, "should we say of a music-master who gave his pupils a sonata of Beethoven to learn the notes on, instead of beginning with scales?" This very course is nevertheless pursued in our present method of teaching languages. Its effect is often not only to blot out absolutely the beauties of the literature thus unfortunately chosen for sacrifice, but to foster a disgust for literature generally. It would have been a thousand times better for the general culture of the pupil to have given him by and by a good translation. There are many persons whose only idea of foreign literature is an uncomfortable road beset with veritable sloughs of despond, out of which it is only possible to climb with the constant aid of grammar and dictionary.

It is Sayce, already quoted, who points out that the grammar of a living language, like the life of the community itself, is constantly in process of change and development. It cannot, accordingly, be held in by rules that, once made, are to stand forever, as unalterable as the laws of the Medes and Persians. Yet, notwithstanding this indisputable fact, there are still in use numerous text-books whose prototype is the old grammar of Donatus. Such a grammar may possibly have its use as a book of reference, but surely not otherwise. You may know your grammar by rule and paragraph from first to last, and be able to apply it in the formation of sentences, but at the same time be utterly unable to form a single sentence as a native would speak it. The old method is really the study of the grammar by means of the language, as if the former, and not the latter, were the end in view.

In the case of the dead languages the instruction should proceed, as far as possible, on the plan laid out for the living ones; and many recent writers are agreed that the study of Greek and Latin should follow rather than precede the modern languages.

Against the so-called 'natural method,' Sweet takes a decided stand. The very term, he says, is a misnomer, for the learning of a foreign language is as unnatural a process as can be imagined.* The genuine natural method, which, if any thing,

would be that followed by nurses and children, is definitely characterized as bad, and, from its wastefulness and absence of system, unworthy of imitation later on. Under the most favorable circumstances, the method is more or less a failure, and the result cannot but be infinitely less productive in the later study of a foreign language, where it is impossible to reproduce those conditions. A language cannot be picked up by ear without systematic study. Even a residence in the foreign country before the elements of the language have been mastered, so far from being advantageous, is positively injurious, as the learner is forced, by the exigences of the moment, to make use of incorrect constructions, which are afterward difficult to get rid of. Klinghardt characterizes Techmer's system, in so far as it concerns the practical acquisition of language, as an example of the 'rationally developed natural method.' There is here, however, a confusion of terms. Techmer does not concern himself solely with the practical acquisition of language, but makes its theoretical study an important and indeed an essential element. The Montaigne-Sauveur method is distinctly stated by him to take but little account of the theoretical knowledge of language. He might have stated with greater fairness that it takes no account of it at all.

In the foregoing, particular stress has purposely been laid upon the views of Techmer and Sweet, as their importance justly demands. While far apart at some points in the development of their respective systems, the two are nevertheless wholly at one in fundamental principles. Techmer, as Klinghardt notes, shows in his treatment of the question the traditional peculiarities of his nation. He begins, in a sense *ab ovo*, with a psychological consideration of language in general, considers the subject carefully in its whole extent, and makes, rightly, the ideal side, the theoretical knowledge of language, both a prominent means and an aim of acquisition. Sweet, on the contrary, sees the question only from its practical side. He does not attempt to give a systematic exposition of the whole question of language, but, convinced that the aim of language-study should be wholly a practical one, develops with admirable rationalness and common sense a system whose mere practicality cannot be disputed. He leaves a place also for theoretical knowledge, but would make it an end in itself, in that he would place it beyond and above the practical acquisition of a language. Particularly valuable is Sweet's vindication of scientific phonetics as a basis of linguistic study.

However the writers here cited may differ in single points of detail after the first stages of instruction have been passed, all with one accord cry out, with a voice that ought not to fall unheeded, for the reform of existing methods. Vietor is right: 'Der Sprachunterricht muss umkehren!' In what essential points it may be reformed has here been pointed out as much in detail as space would permit. In accordance with what has been said, — as Klinghardt puts at the beginning of his article, — language-instruction must apply, as far as possible, the certain results of modern philological investigation. Secondly, grammar is to be at first studied inductively and in connection with the reading texts: when a systematic grammar is finally taken up, it is to be, as much as possible, limited in extent. Finally, instruction must proceed from the stand-point of the spoken language and the sentence. Reform in the teaching of the foreign languages, ancient or modern, cannot, perhaps, be expected to come all at once, or to come of itself. Old practices are too deeply rooted for the exertions of a few thus easily to overturn them; but surely there is nothing inherent in the old method, that it should be retained if something better can be found to take its place. If the results of present methods of instruction, whether in school, academy, or college, are to be taken as a standard whereby to judge of their efficiency, then reform is needed here as in no other place in the curriculum. The matter has been viewed too long with indifference. The old method is inadequate to supply what is demanded of it. Time that can ill be spared, and the drudgery of hard labor, are spent upon it; and the result, in nine cases out of ten, is now what it always has been, — practically nothing! When existing methods, be they educational or economical, are bad, the rational way is to discard them. If they are bad in part, then discard them in part; if bad throughout, then reject them utterly.

WM. H. CARPENTER.

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THE *Athenaeum* states that Mr. H. Howorth, M.P., the historian of the Mongols, is going to bring out a work entitled 'The mammoth and the flood,' in which he endeavors to prove that a wide-spread cataclysm brought the mammoth period to a close, and that this catastrophe involved a wide-spread flood of water which not only drowned the animals, but buried them, sometimes with their bodies intact, and in many cases along with a crowd of very incongruous beasts, and covered them with continuous mantles of loam and gravel.

— The international astronomical society, Astronomische Gesellschaft, meets this year at Kiel on Aug. 29.

# SCIENCE.

FRIDAY, JUNE 17, 1887.


## COMMENT AND CRITICISM.

THE IMMIGRATION INTO THIS COUNTRY during a year is so enormous, that we are apt to overlook the fact that similar movements of population may be taking place elsewhere. To be sure, immigration elsewhere is very small as compared with that here, but it has attracted sufficient notice in England of late to call parliament's attention to it. Investigation proves, however, that any alarm which may have been caused is unnecessary. Comparison of the census of 1881 with that of 1871 shows that the immigration of foreigners into the United Kingdom during that decade cannot have been very large. According to tables which have been prepared, the increase of foreigners resident in the United Kingdom between 1871 and 1881 was from 113,979 to 135,640, or 21,661 in all, equal to just over 2,000 per annum. Having regard to the figures of emigration and immigration dealt with in the board of trade tables, this is of course a small movement. The whole foreign population resident in the United Kingdom in 1881 was in fact less than the net emigration of British and Irish persons from the United Kingdom in a single year. The German empire contributed 35,141 in 1871, and 40,371 in 1881; France, 19,618 in 1871 against 16,194 in 1881; Russia, 9,974 against 15,271; and the United States, 9,467 against 20,014. Thus Germans constituted in 1881 about one-third of the foreign population resident in the United Kingdom; but the increase in the period was no greater than the increase among Russians, and less than the increase among natives of the United States, whose numbers doubled in the ten years. It seems probable that the increase of foreigners since 1881 has been somewhat more rapid than during the decade preceding, but it has not yet become so great as to be at all alarming.

NO PAPER THAT WAS PRESENTED at the recent successful session of the Historical and Economic associations at Boston was more important than that by Col. Carroll D. Wright on 'The study of statistics in colleges.' What he said about the necessity for the scientific study of statistics and their application should be specially emphasized. Colonel Wright, himself a most successful statistician, avowed that during the fourteen years that he had devoted to practical statistics there had not been a single day when he had not felt the need of statistical training, not only for himself, but for those associated with him. He continued, "The problems which the statistician must solve, if they are solved at all, are pressing upon the world. Many chapters of political economy must be rewritten; for the study of political economy is now brought under the historical and comparative method, and statistical science constitutes the greatest auxiliary of such a method. There is so much that is false that creeps into the popular mind, which can only be rectified through the most trustworthy statistical knowledge, that the removal of apprehension alone by it creates a necessity sufficient to command the attention of college authorities. The great questions of the day, the labor-question, temperance, tariff reform, all great topics, demand the auxiliary aid of scientific statistics, and a thorough training is essential for their proper use." Two instances were cited by Colonel Wright to show the way in which crude theories are sometimes upset by carefully gathered statistics: "It has been asserted that there is an alarming amount of illiteracy in Massachusetts. Statistical inquiry shows that by far the greater number of these illiterates are of foreign birth; so that the fault is not with the public-school system, but the evil is due to a temporary cause, namely, immigration. Again: it has been freely asserted that in the United States, women of native birth do not have as many children as women of foreign birth, and that thereby the real American population is steadily losing ground. The census of Massachusetts will show, that although American women do have a less number of children, on the average, yet a larger number survive, so that the alarm is needless. Common observation would never have shown these things, or would not have shown them accurately."

We fancy that the average reader of census-tables has little conception of the many difficul-

ties, purely statistical, which must be surmounted before the tables are completed. Colonel Wright drew from his own experience excellent illustrations of these. "The question may be asked," he said, "what elements of capital are involved in the census question of 'capital invested'? Is it simply the cash capital invested by the concern under consideration, or is it all the money which is used to produce a given quantity of goods? If the members of a firm contribute the sum of $10,000, and they have a line of discounts of $100,000, the avails of which are used in producing $200,000 worth of completed goods, what is the capital invested? What is the capital invested which should be returned in the census? If a man has $5,000 invested in his business as a manufacturer, and he buys his goods on ninety days, or four months, and sells for cash, or thirty days, what is his capital invested? This question is one among many of the practical problems that arise in a statistical bureau, but which has not yet been treated scientifically. What has been the result of the reported statistics relating to capital invested? Simply that calculations, deductions, and arguments based on such statistics have been and are vicious, and will be until all the elements involved in the term are scientifically classified. Another illustration in point arises in connection with the presentation of divorce statistics, especially when it is desired to compare such statistics with marriages, or to make comparisons to show the progress, or the movement of divorces. Shall the number of divorces be compared with the number of marriages celebrated in the year in which the divorces are granted, or with the population, or with the number of married couples living at the time? I need not multiply illustrations. The lies of statistics are unscientific lies." In speaking of the U. S. census, Colonel Wright said, that although we take a census in the United States every ten years, yet, as a rule, the men that are brought into the work know nothing of statistics. They should be trained in the very elementary work of census-taking and of statistical science. It would be much more economical for the government to keep its experienced statisticians busily employed in the interim of census-taking, even if they do no more than study forms, methods, and analyses connected with the presentation of the facts of the preceding census. Money would be saved, results would be more thoroughly appreciated, and problems would be solved. The next congress must make the preliminary arrangements for the eleventh census, and it would be a national gain were Colonel Wright himself put in charge of the work.

## *PHYSICAL CULTURE FOR CRIMINALS.*

IN *Science* for May 13 appeared a favorable notice of an experimental class in physical culture, conducted during the summer of 1886 at the New York state reformatory, and described at length in the last annual report of the board of managers. The class consisted of twelve men, dull and stupid, but not idiots or imbeciles, who seemed incapable of any prolonged mental effort, and who had failed to make any appreciable progress in school-work. The object in view in the formation of the class was to determine if physical culture, with all that the term implies, would not result in at least a partial awakening of dormant mental power in twelve men mentally and morally obtuse.

With physical culture and improvement, there came a mental awakening; and at the end of five months, when the class was discontinued, the men were able to perform operations in simple arithmetic, as division and cancellation, — a thing they had never done before, as the average criminal is remarkably dull in all that pertains to mathematics.

It is now more than six months since the class was given up, and the men assigned to various shops and employments and the primary classes of the reformatory, — a period sufficiently long to determine, in part at least, the value of physical culture as an educational factor.

One man, a southern negro, died during the winter from pulmonary disease, leaving eleven men under observation at the present time. At the time the class was formed nine of these eleven men were in the third grade, and two in the second or intermediate. Five months later, or when the class was discontinued, these nine men had attained the second grade, and the two there originally had maintained their standing. At the present time of writing, six have reached the first grade, leaving five in the second; and of these latter, two have every prospect of reaching the first by the beginning of May.

The average marking of these eleven men for the six months preceding their course of training, and while engaged in shop-work, was as follows: demeanor,— $2\frac{1}{2}$; labor, $2\frac{10}{33}$; school, $1\frac{8}{22}$, or 46 per cent; 3 representing the highest attainable mark in each, or an aggregate of 9 for the time named. During the continuance of the class, and in response to the efforts made to arouse these men

from their state of mental lethargy, their marking in school rose to 74 per cent, and their demeanor proportionately improved. From November, 1886, to April, 1887, inclusive, the men being employed as laborers and at various industries, as brush-drawing, their average marking was as follows: demeanor, $2\frac{1}{8}$; labor, $2\frac{9}{11}$; school, $2\frac{9}{35}$, or 71 per cent, — a great improvement as compared with their record from December, 1885, to May, 1886, inclusive, as given above. The record of these eleven men for corresponding periods before and after their course of physical training presents a marked contrast.

If the improvement noted in these dullards during the time they were receiving their athletic training was the result of better spirits, arising from the novelty of their position, and pride that they were singled out from their fellows for certain work, and removed in a measure from prison monotony, it would be reasonable to expect that with the removal of the stimulus, and the return of all to the routine prison-life, with the consequent loss of the individuality they might have enjoyed, there would come sooner or later a falling-back and lapsing into their previous state of mental inertia. But, returned to the *régime* and discipline observed with other prisoners, they maintained their good record; and, six months after the termination of the experiment, the mental power revealed by their physical-culture course has continued to develop, and the former shuffling gait and stooping shoulders which characterized them as a class have been replaced by an alertness and promptitude of action.

I do not think the improved mental condition of these men can be attributed to other than the strengthening of the brain-centres by the cultivation and development of muscle and muscles under the control of these same nervous centres, the one participating and taking part in the improvement of the other. From the words of commendation I have received, and noting the progress of the men under conditions that once seemed to promise so little to them by reason of their stupidity and obtuseness, I regard my class in physical culture as more than an experiment, — a success, — as showing that something more than mere brawn can be accomplished by muscular exercise when properly selected, guided, and governed. H. D. WEY, M.D.

## *DISTILLERY-MILK REPORT.*[1] — *II.*

IN response to the question, What is your opinion as to the wholesomeness of distillery swill as food for cows? the following were received: —

[1] Continued from p. 553.

[D. W. HAND, M.D.]

I do not believe it to be a wholesome food.

[L. MCLEAN, M.R.C.V.S.]

Detrimental to the general health of any ruminating animal. As such food does not require to be masticated, or remasticated, hence a perverted condition of the ruminating apparatus.

[EDWARD PLAYTER, M.D., editor of the Canadian *Health journal.*]

I have observed a number of items in medical journals (of which I, as editor for twelve years of the Canadian *Health journal*, have received many), referring to the injurious effects of the swill upon the milk of milch-cows fed with it, but I cannot call to mind any facts. Knowing well the effects of dirt upon the organs and secretions of both man and animals, I am convinced that distillery swill, which must constitute a very imperfect food, would furnish but a very inferior milk, and that cows fed chiefly or largely upon such swill give a milk of inferior quality, and not fit for habitual use, especially as food for infants. Animal chemistry and physiology would seem to render this impossible.

[CHARLES SCHAEFFER, M.D., Philadelphia, Penn.]

Upon general principles, I judge that food which breaks down the cow's constitution, very much as chronic alcoholism (which does not result in fatty degeneration) destroys the human constitution, producing diarrhoea and muscular atrophy, is not likely to give a very healthy secretion of milk, but, on the contrary, a poisonous one.

[OSCAR C. DEWOLF, M.D., Chicago, Ill.]

I have been commissioner of health of the city of Chicago for eleven years past, and during that period, until 1885, several hundred milch-cows were constantly fed in distillery sheds in this city. I believe that distillery slop before it has passed into the acetic acid fermentation, and fed in proper quantities to cows running at large, is perfectly wholesome food. I object to so-called 'distillery milk,' because of the close and long confinement of cows, and the dirty methods of gathering and storing the milk. It is probable, also, that cows thus confined do not often receive the quantity of hay they require for vigorous health. These conditions must affect the milk, whether chemists can detect the change or not. Not a cow giving milk for public supply is now fed and confined in a distillery shed in this city, and for reasons above given I shall oppose any attempt to do so.

[WILLIAM OLDWRIGHT, M.D.]

I consider distillery swill an unwholesome food for cows.

WILLIS G. TUCKER, M.D., professor of inorganic and analytical chemistry, Albany medical college.]

I am opposed to the use of such waste as a chief or exclusive diet for milch-cattle, though I do not believe that the feed is the sole cause of disease among cattle in swill-stables, or of the poor milk furnished by them.

[E. H. BARTLEY, M.D.]

Unwholesome both to cows, and to the children fed upon the milk.

[WILLIAM K. NEWTON, M.D.]

I am of the opinion that it is an unwholesome food, and that the milk produced by cows using it is not healthful.

There has been a great deal on this subject published, and all the German authorities agree that stall-fed cows give as good milk as those allowed to graze, due attention being paid to the sanitary condition. In many German cities the milk-supply is obtained from cattle thus cared for. In the last two reports of the Wisconsin experiment-station, very interesting accounts are given about soiling cows; and the results, as to yield and quality of the milk, are nearly the same as from cows allowed to feed in the pasture. In the soiling method the food is all given to the cows in the stalls, and they are only allowed in the barnyard for exercise, and on clear days. The cows are turned into milk-making machines.

In the case of distillery swill, the cattle are not only fed on an unnatural food, but are at the same time subjected to very unsanitary conditions; and both combined cause disease, and hence the product must, of necessity, be unhealthful. I am pretty certain that those scientific men who are willing to indorse this business are either not acquainted with the subject, or confound proper soiling with the methods in vogue at Blissville. The two systems are separate and distinct.

[J. BLAKE WHITE, M.D.]

Positively unwholesome.

[GEORGE H. ROHÉ, M.D.]

I have no hesitation in saying that distillery swill is not only unhurtful, but desirable as food for dairy cattle. I have seen no trustworthy evidence that the bad results of stall-feeding in dairies are due to this food. I would desire to express my opinion as emphatically as possible upon this point.

[PROF. WILLIAM H. BREWER.]

I have an *opinion*, founded on reading rather than observation, that milk from cows fed principally or largely on distillery swill is *decidedly unwholesome*, but that distillery swill may be used in small quantities, along with other food, without seriously or demonstrably deteriorating the wholesomeness of milk; that the evil effect is largely a matter of relative quantity of swill to other food. Moreover, the surroundings of the cows in swill-milk stables as usually kept, and also the health of the cows as usually found in those stables, is, or are, factors causing much of the alleged unwholesomeness. Milk is an easy carrier of smells and disease.

[HENRY HARTSHORNE, M.D.]

My supposition is, that it is very likely to contain a remnant of alcohol, and that this must interfere with its suitableness for cattle-food. If this be so, it is also *possible* that a small portion of alcohol may pass through the cow's blood into the milk, to the injury of infants fed upon it. But such possibilities are only sufficient to justify careful *investigation*. At the best, however, such material is obviously very far removed from the condition of natural food for cows.

[E. M. NELSON, M.D.]

I think it is not a wholesome food, and that the milk from swill-fed cows is excessively acid, decomposes early, and predisposes to disturbances of digestion.

[W. SIMON, PH.D.]

My opinion, based on my examination in 1882 and numerous observations made in various localities since that time, is that 'swill,' when used in moderate quantities alongside of plenty of hay, grass, or other similar food, is a highly valuable article for feeding cattle. On the other side, swill becomes dangerous when fed in too large quantities, most likely on account of its high percentage of nitrogenous matter.

[CHARLES AMBROOK, M.D., Boulder, Col.]

If made an exclusive diet, unwholesome; if not exceeding one-quarter of whole diet, and good pasturage always at hand, nothing very detrimental in distillery food that I have seen.

[A. J. HOWE, M.D., Cincinnati, O.]

Distillery slop blackens the teeth of kine,—cows or oxen,—makes their breath offensive, gives them diarrhoea, and weakens the muscular system to a degree that, though fat, the creatures can hardly walk. The above I know from observation.

[NORMAN S. BRIDGE, M.D.]

That it is an unnatural food; almost sure, sooner or later, to cause some disease in the cows, unless it is freely mixed with a large quantity of other and more natural food. Doubtless the complaints referred to under No. 2 were mainly in

cases where the milk used was from cows the health of which had undergone some deterioration from the diet referred to.

[J. L. HAMILTON, M.D., Peoria, Ill.]

Since our dairies have been removed to the country, and the cows fed on other food, and some slop still used, the effect of the still-slop is not noticed. Of course, there are other things as well as the slop. When cows are kept up in barns, and fed only on still-slop, the air they breathe is very impure, and they will drink but little water and have no exercise. This contributes to the unhealthiness of dairy milk.

[C. A. ROBILLARD, M.D.]

Knowing that this matter is extensively used in some parts for fattening purposes, and that healthy beef is brought to the market as a result of this mode of feeding, I would incline to the belief that the milk from cows so fed is all right. I am not prepared, however, to state positively that it should be so under all circumstances.

[JAMES E. REEVES, M.D., Wheeling, W.Va., formerly secretary state board of health.]

My observation, from the stand-point of the general practitioner of medicine, fully warrants the belief that the milk of town-fed cows — feeding on slops, garbage, and brewery refuse — is dangerous to the public health.

[HENRY D. HOLTON, M.D., Brattleborough, Vt.]

Here in Vermont we do not have any thing of the kind; yet we are well aware that the food of the cow has much to do with the quality of the milk and butter. In summer, dairymen know from experience and observation that there is a great difference in the pastures. When cows are in some pastures, the milk, and especially the butter, is much better than when in others. Many people can tell butter made when the cows are fed on cottonseed-meal instead of corn-meal. It is also true that the milk of cows who are worried or frightened will sour much quicker than when not so worried. Infants fed with the milk of cows worried or heated by running (as is sometimes done by boys in bringing them from the pasture) will suffer from colic, and often from diarrhoea. There is no doubt in my mind that swill from distilleries would produce a very poor quality of milk.

[D. L. PHARES, M.D., member of state board of health, Agricultural college P.O., Miss.]

That it is unwholesome. In small quantity, combined with plenty of good, sound normal cow-food, it may do no serious injury; but in any considerable quantity it is, in my opinion, unwholesome. The nature and condition of the substance seem to me to justify this opinion. True, it may for a time seem to improve the condition of the cow, but even then the physiologist and pathologist can detect evidences of damage.

[G. A. LIEBIG, Baltimore, Md.]

I would unhesitatingly prefer other than milk from cows so fed, not only for the reason of character of food, but also for the manner of treatment of the animals, — housing, etc.

[R. HARVEY REED, secretary Ohio state board of health.]

I think distillery swill is very objectionable food.

[L. M. KENYON, M.D. Buffalo, N.Y.]

I think, from what I have read from time to time, and know from what little I have seen, that it is most decidedly detrimental, although I can now give no detail, or specially individual cases.

[J. F. KENNEDY, M.D., secretary Iowa state board of health, Des Moines, Io.]

Upon general principles, I should consider such food as injurious to the cows, and hence productive of milk injurious to those using it, especially to children largely dependent upon it.

[F. N. BOKER, sanitary engineer, Montreal, Can.]

Decidedly unwholesome. It soon acquires a rotten flavor, and is deceptive as to nourishment. During our long Canadian winter in Montreal, a good deal of swill is given to milch-cows to increase the flow of milk; and, as the mortality among young children is very great in this city, I attribute it to the poor quality of the milk, etc.

[*To be continued.*]

## *EXPLORATION AND TRAVEL.*

### *Lieutenant Wissmann's expedition.*

IN *Science* of April 22 we referred to Lieutenant Wissmann's trip from Luluaburg to the Lubilash. A letter from Wissmann which was published in the *Verhandlungen der Gesellschaft für Erdkunde*, April, 1887, contains the following interesting details. He ascended the Lulua as far as Katende (the situation of which may be seen on our map of Central Africa). Here he visited the grand Lulumba Falls, which are the termination of the navigable part of the Lulua. He had some difficulty in crossing the river, on account of the hostility of the natives. He proceeded eastward, and, after crossing the river Moio on a bridge, reached Tenda-Mota. Here is the boundary between the Bashilange and Bagna-Kalosh, who belong to the Baluba. The Kalosh and their eastern neighbors live in small villages of from four to ten houses, which are surrounded by fields in which they

grow sweet-potatoes, hirse, and manioc of a poor quality. There is scarcely any uncultivated land, one field adjoining the other, and one village being close to the other. Wherever a patch of uncultivated land exists, it is prairie, with scattered shrubs three feet in height. The land is not very fertile, and does not yield large crops. On the steep knolls which form the watersheds there are a few large trees. The banks of brooks and rivers are barren, and in some places the hills and plains are covered with granite bowlders. Very few bananas are grown in the villages. The men are very tall, and have heavy bones. They wear head-dresses made of feathers, and have their hair arranged in a thick knot on the back part of the head, and in numerous small knots in front. Their spears are generally made of hard wood: they always carry a club, and use the broad knife of the Lunda. Wissmann considers them one of the finest-looking peoples of Central Africa.

It was impossible to buy any thing, as the population was too dense. Small-pox is endemical. On the Buchimayi, a western tributary of the Lubilash, the natives attacked the caravan, and Wissmann was compelled to return to Luluaburg. In October, 1886, he started on his journey to the unknown district between the Sankuru and the upper Kongo. He writes that the natives informed him of the existence of lakes similar to Lake Mantumba and Lake Leopold in this region. It is worth remarking, that, according to Dr. Wolf's observations, the Sankuru has no tributaries on its right bank. There are only a few small brooks, which have black water. This shows that they come from a swampy region. The Busera, Juapa, and Lubilash, on the other hand, which come from the same region, have water of a light yellowish color. Wissmann intends to explore this watershed, and to reach the Kongo near Nyangwe.

In regard to the Bashilange and Bateke tribes, Wissmann says that probably Baluba, who emigrated from the upper Lubilash, intermarried with a people similar to the dwarfish Watwa. Of these, the Bashilange and Batcke are the descendants. In their districts no tribe of dwarfish stature exists, while they may be found among the Bakuba, Basonge, Wanyĕma, and Baluba. The Baluba occupy the whole territory as far east as the Tanganyika, Lukuga, and Lake Meru. The King of Lunda, the Muata Yamvo, is of Baluba descent. The remarks on the anthropological features of the Bashilange agree with the views of R. Virchow, expressed some months ago (*Verh. der anthrop. Ges.*, Berlin, 1886), when discussing the valuable anthropological measurements and the skulls collected by Dr. Wolf on his memorable journeys in Central Africa. Virchow says that the anthropological features of these tribes are those of a mixed race, the negro type prevailing. He does not express an opinion as to the second element. His conclusions are supported and completed by Wissmann's ethnological observations on the non-existence of a dwarfish population in the territories inhabited by the Bashilange.

*Asia.*

General Ignatief, governor of eastern Siberia, has proposed the exploration of part of the frontiers between Russia and China. A large expedition is being equipped, which is to visit the Saïansky Mountains and the Kossogol west of Irkutsk. Colonel Bobyz is the leader of the expedition, which will last from five to six months (*Gaz. géogr.*, May 19).

The Imperial geographical society of St. Petersburg proposes to study the periodical changes and the gradual desiccation of the lakes of western Siberia. The plan of the work is designed by Potanin, Yadriutzef, and other Russian explorers of northern Asia, the president of the committee being Mr. Stebnitzky.

Mr. B. C. Henry has made a second visit to the Island of Haiman. He visited the aborigines of the mountain region, reaching the geographical centre of the Lee territory, and demonstrating the fact that this region, supposed to be impassable, can be traversed from east to west and from north to south with comparative ease (*Proc. Roy. geogr. soc.*, June).

*Africa.*

A Reuter's telegram from S. Paul de Loanda, dated May 26 (*Scottish geogr. mag.*, June), announces the arrival of Mr. Stanley's expedition at Leopoldville on April 20, all well, and the departure of the main body nine days later.

*Le mouvement géographique* publishes a brief description of the exploration of the river Inkissi, which empties into the Kongo near Stanley Pool, coming from the south. The explorer, Lieutenant Hakansson, started on his expedition on the 6th of November. For three days he passed through a barren desert, but then the country became more fertile and settled. This observation is of some importance on account of the disputed extent of the barren district on the west coast of Africa. From all observations, it appears that the region of the lower Kongo, though generally very dry and barren, contains numerous patches of fertile land. The population of the Inkissi consists mainly of Bakongo.

Mr. J. T. Last, who has followed up the work of Mr. O'Neill by exploring the Namuli Hills and the Lukugu valley, has arrived at Zanzibar. He

has carried out the programme of his journey, though he found the summit of the Namuli Hills inaccessible, and in addition traversed the whole region a second time, striking into the interior from Kwilimane, and emerging at Ibo on the Mozambique coast (*Proc. Roy. geogr. soc.*, June).

*America.*

Under the auspices of the Italian geographical society, Count Ermanno Stradelli from Piacenza, who has travelled for many years on the Amazon and its tributaries, is going to explore the head waters of the Orinoco, which were visited in the beginning of this year by Chaffanjon (*Boll. Soc. geogr. Ital.*, May).

Prof. Dr. R. A. Philippi writes to *Petermann's Mittheilungen* that the Chilian government has sent out two expeditions to survey the boundary between Chili and the Argentine Republic from Rio Palena to the pass of Villarica. It appears that the Cordillera is situated in Chilian territory, while the watershed between the Atlantic and Pacific oceans, which forms the boundary, lies east of the mountains, about 1,600 feet high. One of the expeditions will cross the Ranco pass east of Valdivia, and return by the pass of Villarica. The time allowed to the expedition is from two to two and a half months.

## *HEALTH MATTERS.*

Yellow-fever at Key West. — The existence of yellow-fever at Key West is officially recognized and declared epidemic by its board of health. In a proclamation issued by that body, it is stated that an effort is being made to conceal cases, and to resist the health officers. The board announces that a bulletin will each day at noon give the status of the epidemic, naming new cases, deaths, and recoveries. Reports are required from every householder of any sickness which may occur in his family. Unacclimated persons are required to remove from the infected district, and are advised to leave the island. Proprietors of saloons are especially called upon to refuse drinks to those inclined to abuse the use of the same, since such persons taken with fever are nearly hopeless cases, and their deaths add to the mortality list, and tend to increase mortality among others.

Pleuro-pneumonia in Westchester. — There has been an extensive outbreak of contagious pleuro-pneumonia among the cattle near Golden's Bridge, Westchester county, N.Y. In one of the affected herds there are two hundred and sixty head of cattle. In addition to this, several smaller herds are affected. The cattle have been appraised under the direction of the U. S. bureau of animal industry, of which Dr. D. E. Salmon is chief, and are being slaughtered. It is the hope of Dr. Salmon to eradicate the disease from the county.

## *NOTES AND NEWS.*

An *Archiv für Geschichte der Philosophie* will shortly appear in Berlin. The editor-in-chief is to be Prof. Ludwig Stein of Zurich.

— The *Athenaeum* announces that the well-known Swedish botanist, Prof. Johan Edvard Areschoug, died at Stockholm on the 7th of May. He was born in 1811, and worked under Agardh and Fries at Lund. He was made reader in botany at that university in 1839, and in 1858 was appointed to succeed Elias Fries as professor of botany at the University of Upsala. Among his numerous publications, those best known are his 'Symbolae algarum florae Scandinaviae,' his 'Iconographia phyctologia,' and his 'Phyceae marinae.' Areschoug retired from his chair in 1876. On the same day the Swedish statistical writer, Dr. Fredrik Theodor Berg, died in Stockholm, in his eighty-first year.

— Messrs. John Wiley & Sons, New York, have issued an admirable catalogue of their publications, which cover every department of the mathematical sciences and of engineering.

— The second number in the series of monographs on political economy and public law, edited by Prof. Edmund J. James, and published by the University of Pennsylvania, will shortly appear. It treats of the anti-rent riots in New York, 1839–46, an important but hitherto almost entirely neglected chapter in American economic history. The author, Mr. E. P. Cheyney, instructor of history in the University of Pennsylvania, finds the source of the difficulties, which in many respects resemble the present Irish land-troubles, in the peculiar land-tenures of early New York. A vivid description is given of the rise and progress of the riots, and a full account of the numerous and important changes in the constitution and laws of the state, which followed as a result of this movement.

— On Friday, May 13, the Hon. Ion Grant Neville Keith-Falconer died at Aden, and with him one of England's most promising scholars passed away. Mr. Keith-Falconer was born in 1856, and graduated at Trinity college, Cambridge, in 1878, attaining high honors in Semitic languages. After a period of study in Germany and the east, he became Hebrew lecturer at Clare college; and on the resignation of Professor Robertson Smith in June, 1886, he was appointed

lord-almoner's reader in Arabic for the University of Cambridge. His published writings are principally on philological topics; and the article on 'Shorthand,' in the 'Encyclopaedia Britannica,' is from his pen.

— The twenty-second volume of the 'Encyclopaedia Britannica,' completing the letter 'S,' is now ready. The principal literary and scientific articles are, 'The sonnet,' by Mr. Theodore Watts; 'Sophocles,' by Professor Campbell; 'Spanish literature,' by M. Morel Fatio, the first Spanish scholar in Europe; 'Swedish literature,' by Mr. Gosse; 'Syriac literature,' by Professor Wright; 'Dean Stanley,' by the present dean of Westminster; 'Socrates,' by H. Jackson; 'Stoics,' by D. Hicks; 'Slavs,' by Mr. Morfill; 'Slavery,' by Dr. Ingram; 'Skeleton,' by Prof. St. George Mivart; 'Sponges,' by Dr. Sollas; 'Steam-engine,' by Professor Ewing; 'Sun,' by Mr. Lockyer; 'Surface,' by Professor Cayley; 'Surgery,' by Professor Chiene and three other contributors; 'Spiritualism,' by Mrs. Henry Sidgwick; and 'Sword,' by Prof. F. Pollock.

— The issue of the *Home journal* dated June 15 contains a most complete summer-resort guide. Where to start from, how to go, what it costs to stay, the natural attractions of the different regions, and the accommodations offered by the various hotels at the summer-resorts, are all very clearly and faithfully set down.

— Hon. David A. Wells will contribute to the July *Popular science monthly* the first of an important series of papers on 'The economic disturbances since 1873.' Mr. Wells proposes to review the history of these disturbances, and to point out agencies to which such wide-reaching commercial depression may be properly attributed.

— The two latest monographs issued by the American historical association are 'History of the doctrine of comets,' by ex-President Andrew D. White of Cornell; and 'William Usselinx, founder of the Dutch and Swedish West India companies,' by Dr. J. F. Jameson of Johns Hopkins university.

— The progress made in educating the negroes of the south will be set forth in *The American magazine* for July. The Rev. S. W. Culver, president of Bishop college, Texas, describes the methods of instruction, and the measure of success attained.

— Prof. M. Max Müller's three lectures — 'The simplicity of language,' 'The identity of language and thought,' and 'The simplicity of thought'— given at the Royal institution, London, last March, have been secured for the columns of *The open court*, Chicago. The first of these remarkable lectures was contributed to the May number of the *Fortnightly review:* the other two have not been published, and will be printed for the first time in *The open court*, and from the author's manuscript. The publication of these lectures commenced in *The open court* of June 9.

— The *Harvard university bulletin* announces that the corporation have authorized the publication, through Charles Scribner's Sons, of a memorial edition of the late Prof. E. A. Sophocles' 'Greek lexicon of the Roman and Byzantine periods,' under the oversight of Prof. Joseph Henry Thayer.

— Charles L. Webster & Co., the publishers, sent Mrs. Grant a check for $33,384.53 last week as additional profits on General Grant's 'Memoirs.' She has received thus far nearly $400,000, which is probably the largest amount of money ever earned by the writing of a single book.

— Cupples & Hurd have in preparation a life of Commodore Matthew C. Perry, who was so instrumental in opening the ports of Japan to the world. It will give a complete history of this 'typical naval officer' from the time when, as a midshipman, he served in the war of 1812, to the treaty with Japan.

— Messrs. Macmillan & Co. have published 'Dynamics for beginners,' by Rev. J. G. Lock. This work has been written in the hope of supplying a want, which many teachers have felt, of a book which explains the elementary principles of dynamics, and at the same time illustrates them by numerous easy numerical examples suitable for use in schools with boys of ordinary mathematical attainments. It must be regretted, however, that the author has seen fit to suggest names for the units of velocity and acceleration, as the science of physics threatens to be overburdened with an unnecessary nomenclature.

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## *LETTERS TO THE EDITOR.*

****The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The Charleston earthquake.

THE admirable paper on the 'Charleston earthquake' in *Science* of May 20, by Messrs. Dutton and Hayden, is an illustration of what may be accom-

plished by the patient and laborious investigation of a mass of evidence, much of which is unsatisfactory, and not a little of it untrustworthy. That the paper contains so much that is valuable and interesting is greatly to the credit of its authors; and its real importance as the most, indeed the only, elaborate discussion of that interesting seismic event which has thus far appeared, renders a careful examination of its methods and conclusions extremely desirable. I wish to remark upon a few points, concerning which I am compelled to dissent from the views expressed in the paper.

Great labor has evidently been expended on the construction of the isoseismal chart; and doubtless all has been done that can be, with the uncertain data available. Two serious but well-recognized difficulties are met with in attempting the construction of 'intensity' curves: one is the variability and inconsistency of the physical evidences of disturbance, and the other is the unreliability of human testimony as to its extent. In earthquakes of much violence a considerable area near the origin may present evidence which outlasts the disturbance itself, such as overthrown or damaged buildings, chimneys overturned, monuments displaced, etc., and which, therefore, may be studied at leisure. A little experience in the examination of this sort of evidence proves conclusively that a given result is an extremely complex function of a large number of 'independent variables,' most of which, unfortunately, are and must be unknown. It thus becomes difficult to determine the ratio between the varying magnitudes of any one of these variables, so largely is the visible result influenced by the others.

The available source of information consists generally of the effects of the disturbance upon structures of various kinds. Nothing can be more conflicting than the results of such observations, even on areas so small that it seems impossible to admit that differences in actual earth-movement have existed. Within a hundred feet of each other will be found buildings nearly destroyed, and buildings, apparently similar in construction, almost uninjured. Here a monument or shaft is overthrown; and there, a few feet away, another on a much less stable foundation is undisturbed. In a room in which heavy bookcases have been dashed upon the floor, and the furniture generally wrecked, delicate ornaments still rest upon the mantelpiece, and, without crack or scratch, seem to deny all possibility of violent motion. In short, one is forced to the conclusion that the character and amount of destruction caused by an earthquake depend largely on circumstances other than the motion of the earth-particle. An earthquake must be studied in the light of what it has failed to do, as well as of what it has done; and much consideration should be given to what might have happened but did not.

If such widely different effects can be produced by earth-movements which must be practically the same, it is clear that they cannot be very accurate measures of the intensity of seismic disturbances. In a general way, and if extended over an area which includes decided changes in the extent of surface destruction, such observations are extremely useful as indicating zones of unequal disturbance; and especially so, as, in the absence of instrumental records, they furnish about all the available facts.

The nature of the data furnished by the careful and conscientious survey of Mr. Sloan is not stated; but it is perfectly safe to say, that, whatever it may be, Messrs. Dutton and Hayden have made the most of it.

Without intending any special criticism upon the method of treatment adopted, I desire to call attention to the uncertainty, which seems to be great, in the construction of equal intensity-curves with any attempt at precision in form or position, when they are based upon observations of such physical disturbances as are referred to above.

If such records of the disturbance as are left by the earthquake itself are of doubtful and uncertain value, still more so must be the data resting entirely upon the testimony of observers of transient phenomena. It is by no means uncommon for two persons sitting in the same room, and disturbed by the same moderate earthquake, to differ decidedly in their estimate of its intensity.

In two differently constructed or differently situated buildings near to each other the difference is very great. Nor will it do to depend upon the disturbance of movable objects, such as swinging-lamps, etc. Very much depends upon the character of the movement, — as to whether the motion is principally horizontal or vertical, the period long or short, and the synchronism of that period with that of the moving object. Innumerable illustrations of this fact might be given. Disturbances of unusually large amplitude but long period are sometimes scarcely perceptible to the observer. Professor Milne recorded a disturbance in Tokyo on Nov. 23, 1884, of which he says, "Whilst standing up, it was with difficulty perceptible. In the same room, however, those who were seated felt it distinctly. It made a lamp six feet long swing through an arc about six inches."

In 1881 an earthquake occurred at Sapporo (Japan), concerning which the observer made this note: "Wire of hanging-lamp four feet long described an arc of twelve inches; not personally observed; was walking on the street, and nothing was noticed."

Besides the physical environment of the observer, his physiological and psychological peculiarities largely control his estimate of the extent of the disturbance.

In the collection of information by means of distributed circulars, it is impossible to avoid these difficulties, and to obtain any thing like a fair estimate of the character of the phenomenon, especially as most observers are inexperienced. A circular sent to a village is generally likely to find its way into the hands of the particular inhabitant who can give the most startling account of what he saw and felt, and who was naturally most thoroughly frightened.

It appears, therefore, that as far as the value of the collected data is concerned, the great area disturbed by this earthquake might be divided into three zones. The first is small, surrounding and including the epicentrum, and the visible evidences of the intensity of the shock were carefully studied by a sagacious observer within a few weeks of its occurrence. The second consists of the remainder of the area within two or three hundred miles of the epicentral tract, throughout which, though to a constantly diminishing extent, overthrown chimneys, displaced shafts, cracked walls, etc., remained as exponents of the character and magnitude of the disturbance. From this region, however, evidence

came through circular letters, newspaper reports, etc., with which untrained and not very trustworthy observers have much to do. The third zone consists of all that is left of the disturbed area: over it the effects were transient, and all evidence rests on human testimony, unsupported by that of material objects.

Thus it would seem, that, in the construction of the map, isoseismal lines would be drawn with three different degrees of confidence, and that they must be drawn more freely, and with less attention to detail, as they are farther removed from the epicentral tract. Local variations in intensity-estimates should have less weight, and the lines would approximate more nearly to smooth curves. On the map as drawn by Messrs. Dutton and Hayden, this order of things appears to be reversed: the smoothest, most regular curves are those immediately surrounding the epicentrum, while they become more irregular as the distance from that point increases.

In work of this kind, irregular and sinuous lines imply numerous and reliable observations, while those more regularly and uniformly curved will generally be drawn for areas over which observations are few, and not of sufficient weight to show more than the general trend of the line. For these reasons it appears to me that the map is faulty, in that too much weight has been given to individual observations at great distances from the epicentrum; that the sinuosities and irregularities in the lines, particularly those of the Mississippi valley, do not represent any thing real; that they should be smoothed out; and that it is doubtful if sufficient evidence exists for the construction of the two isolated areas, surrounded by closed curves, which appear in northern Illinois and in southern Indiana and Illinois. I venture to suggest, in regard to the latter 'area of silence,' that its existence may to some extent be due to the fact that information concerning that area was collected several months after the occurrence of the earthquake.

One of the most interesting features of this paper is the method employed in determining the depth of the seismic centre. Under certain restrictions, no criticism can be made upon the analysis of the problem; but in its practical application it is, in my judgment, open to serious objection. It is not easy to decide what is the best measure of the 'intensity' of an earthquake. A simple expression for it, and that accepted by Messrs. Dutton and Hayden, is 'the energy per unit area of wave-front.'

This definition once adopted, their analytical and graphic treatment of the problem is elegant and satisfactory; but in the application of the method to the Charleston earthquake, or to any other, it is important to ask whether any means exists for determining the 'intensity' as defined above. While it is true that the disappearance of the consonant $a$ from the abscissa of the points of inflection renders it independent of the *absolute* intensity, it must not be forgotten that in determining *relative* intensities the thing to be kept in mind is 'the energy per unit area of wave-front.' As far as can be seen from the contents of the paper, the result depends on the unjustifiable assumption that *surface destruction* is proportional to this. It is a well-established fact that the destructive effects of a motion are not proportional to the energy involved, and in earthquakes many things combine to produce what is ordinarily called the 'intensity' of the shock, or, perhaps better, its 'destructiveness.' An exact expression for this is extremely desirable, and it seems to me that Professor Milne has approximated to it pretty closely in adopting, as he has, the 'maximum acceleration of the earth-particle in a horizontal plane.' There can be little doubt that horizontal movement is more effective in overturning and destroying buildings, chimneys, etc., than vertical; yet the fact, if it be a fact, finds no expression in the method of Messrs. Dutton and Hayden. Their formula and curve demand the maximum intensity at the epicentrum; and this is correct, according to their definition of intensity.

But does the greatest destruction take place at the epicentrum, or is it to be found in a zone whose radius depends on the depth of the seismic centre? I would not venture to place my own judgment, based upon a hasty examination along a single line, against that of an observer who has gone more leisurely over the field; but, as I can nowhere discover in the paper a distinct statement as to where the *most destructive effects* were observed, I may remark that it appeared to me that there was much less destruction in the neighborhood of the epicentrum, where the vertical component of the motion seemed to have predominated, than in and about the city of Charleston.

Of course, it is possible that from a study of the surface disturbance the relative amount of energy per unit area of wave-front at different points may have been worked out, and the point of inflection found from these results; but it would be an extremely complex problem, and, in addition to difficulties already suggested, it is complicated by the fact that the normal motion of the particle must be changed as the wave emerges from the earth: this, indeed, would stand in the way of getting just what is desired from perfect instrumental records, as, at best, they can only reveal surface movements.

I am unable to agree with the conclusion of Messrs. Dutton and Hayden expressed in the statement that the amplitude of vibration of the earth-particle was in some places not less than ten inches or a foot. So large an amplitude appears to me to be extremely improbable. It is only within a few years that any thing like accurate measures of amplitude have been made; and it is well known, that, wherever it has been measured, it has been found to be small.

In the 'general run' of Japanese earthquakes, the amplitude has been found to be not much greater than a millimetre, and often less. In a few cases it has been several millimetres; and I believe in one or two, which were nearly 'destructive,' and by which chimneys were overthrown and walls cracked, it has been as high as ten or twelve millimetres. It will be noticed, however, in examining these reports, that, in most of the cases in which large amplitudes are reported, the disturbances were of unusual length.

Although, in the construction of their numerous 'steady-point' seismographs, Messrs. Gray<br>Ewing<br>Milne (I want to be careful not to put any one of these names first) have well-nigh revolutionized the science of seismology, I am inclined to the opinion that in a prolonged disturbance the 'steady point' is likely to be set in motion, and that a magnification of the amplitude may sometimes result. A very large

amplitude is to my mind incompatible with innumerable observations of *what did not happen* in Charleston. I admit the difficulty of the problem, but think it easier to account for large displacements by successive movements of small amplitudes.

I must also dissent from the opinion expressed as to the value of stopped clocks as a means of determining the time of the wave-transit. Is it not likely that most of the inconsistencies which appear on a comparison of such data arose out of the fact that many of the clocks were not correctly regulated to 75th meridian time, or that their errors were not known? The man whose clock or watch is 'just right' is met with at every turn, especially after an earthquake; but to most people this means that the error is not greater than a minute or two.

If all of the stopped clocks in the area disturbed had been in exact agreement before the shock, I do not think the errors would have been very great; except, perhaps, in the immediate vicinity of the source. The stopping of all clocks at any considerable distance probably occurred at the transit of the same great wave. Of course, a properly adjusted seismoscope with a clock attached is infinitely better, but I do not have great confidence in the 'observer with watch in hand.' Most intelligent observers in this country must be classed as inexperienced: the watch is not generally in his hand until after he is convinced that the something which has happened is an earthquake, and then it is very likely to have a large and unknown error. Should the disturbance be so considerable as to threaten to be destructive, the skill of the observer in 'measuring a part of the shock and estimating the beginning' is tolerably certain to be overshadowed by his disposition to seek a place of safety. The position and environment of the observer at the time of the occurrence will greatly influence the character of the phenomenon. As an illustration, I may compare my own observations with those of Professor Newcomb, when the Charleston earthquake was felt in Washington City.

I was seated in my library on the second floor of a three-story brick building, about four squares from the state, war, and navy building. As soon as the disturbance was felt, the time was noted. In a moment the motion became very strong. My small boy, who had been awakened out of a sound sleep, rushed into the room; and the family quickly decided to do what it had often done before under such circumstances, and found its way to the street. By the time this was accomplished all was quiet; and in two minutes from the beginning we were again seated in the same room, discussing the shock. In a few minutes, about five from the beginning, another shock occurred, much less violent than the first.

Professor Newcomb "observed a duration of perceptible tremors, with two maxima lasting about five and one-half minutes."

There is, of course, no doubt but what these tremors were felt, but it may be a question whether they were prolonged vibrations of the building in which Professor Newcomb was, or real earth-movements. I am pretty sensitive to earthquakes, and I can say with certainty that they were not felt by me or by my family.

Everybody, I am sure, will agree that it is highly important to establish a large number of observing-stations, equipped with the best instrumental appliances which can be obtained. Even so small a number as ten or twenty such stations, well distributed over the area disturbed by the Charleston earthquake, would have put us a long way in advance of our present knowledge of seismology. It is greatly to be hoped that the able and interesting discussion of the subject, which Messrs. Dutton and Hayden have evolved from the mass of observations which they have gathered with so much industry, will serve to direct the attention of intelligent people to the importance of such a system of observing-stations, and that in the near future the director of the geological survey will be enabled to establish it.

T. C. M.

Terre Haute, June 1.

## Museums of ethnology and their classification.

The remarks of Dr. Boas and Professor Mason on the classification of ethnological material raise questions which must occur to every one who has before him unclassified material. As both views include a part of the truth, the decision on the course to be adopted must depend upon the amount of material to be handled, the space available for its exhibition, and the purpose most at heart in the organization of the museum considered as an agency for effecting a purpose.

The ideal way, if all circumstances were favorable, would be to have a double series,— one representing the culture of each people as an ethnic unit; and the other a comparative collection illustrating the relations to a common standard of the items making up each tribal aggregation. In ninety-nine museums out of a hundred, this would be impracticable, owing to the expense involved, the exhibition space required, and the difficulty of obtaining sufficient duplicate material for two series. The decision must therefore depend on the object to be attained. Is this to show the manner in which tools, weapons, dress, etc., have been elaborated, under the operation of the environment, by the human mind in varying stages of development, or is it rather to convey to the observer the resultant of all the forces acting in and on a comparable series of ethnic types or units, each complete in itself? In either case the object is a worthy one, and to be attained in its particular manner. Neither is likely to be completely attained under the existing conditions of museums in this or any other country; but, as attempted in different collections, we may regard them as complementing each other. In the one case, as very truly observed by Dr. Boas, we are helped to a knowledge of what problems exist; and it is no little matter to have a rational sailing-direction over a trackless ocean, though the accurate chart is still to be made. In the other, we have the equivalent of the monographic study of the specialist who surveys in detail, and for all time, a gulf or harbor forming a small part of the oceanic coast.

To conclude, for the people at large and the majority of those who profit by public museums, I believe the greatest amount of satisfaction and instruction is to be obtained rather from an ethnic arrangement than from the organic method; but this is merely an expression of my individual preference.

WM. H. DALL.

Washington, D.C., June 4.

Prof. Otis T. Mason's reply to my remarks on his views of the methods of ethnology is mainly a justi-

fication of his plan of arranging the collections of the national museum. As this plan is the outcome of his philosophical view of the problems of ethnology, we must scrutinize these in order to judge as to the merits of his system.

His principal object is the study of each and every invention among peoples of all races and countries. I am well aware that this idea was and is shared by many scientists; and at this very moment I read with interest Mantegazza's proposal of erecting a 'psychological museum,' i.e., a museum of ethnological objects arranged according to the ideas to which they belong. Professor Mason's rank among American ethnologists, however, and the weight he can give to his opinions by the arrangement of the large collections of the national museum according to his theories, induce me to criticise his views more particularly.

My view of the study of ethnology is this: the object of our science is to understand the phenomena called ethnological and anthropological, in the widest sense of those words, — in their historical development and geographical distribution, and in their physiological and psychological foundation. These two branches are opposed to each other in the same way as are biology and the so-called systematic 'organology,' or, as I have called it in another place (*Science*, ix. No. 210), when treating on the study of geography, 'physical science and cosmography;' the former trying to deduce laws from phenomena, the latter having for its aim a description and explanation of phenomena. I tried to show that both branches are of equal scientific value.

Let us inquire which method must be applied to carry on ethnological researches of either kind. Ethnological phenomena are the result of the physical and psychical character of men, and of its development under the influence of the surroundings: therefore two problems must be studied for attaining scientific results. The preliminary study is that of the surroundings: the final aim of the researches is the knowledge of the laws and history of the development of the physiological and psychological character of mankind. 'Surroundings' are the physical conditions of the country, and the sociological phenomena, i.e., the relation of man to man. Furthermore, the study of the present surroundings is insufficient: the history of the people, the influence of the regions through which it passed on its migrations, and the people with whom it came into contact, must be considered. All of these are phenomena which may directly be observed by a well-trained observer, or may be traced with greater or less accuracy by historical researches.

The second part of ethnological researches is far more difficult. The physical and psychical character of a people is in itself the result of the action of the surroundings, and of the way in which the present character was attained. Each stage in the development of a people leaves its stamp, which cannot be destroyed by future events. Thus it appears that the elements of the character of a people are extremely complex. There are two ways of treating this problem.

One of the remarkable features of such problems is the occurrence of similar inventions in regions widely apart, and without having a common origin. One method of studying them — and this is Professor Mason's method — is to compare the phenomena, and to draw conclusions by analogy. It is the deductive method. The other method is to study phenomena arising from a common psychical cause among all tribes and as influenced by their surroundings; i.e., by tracing the full history of the single phenomenon. This is the inductive method. For this method of study, the tribal arrangement of museum specimens is the only satisfatory one, as it represents the physical and ethnical surroundings.

I will explain these ideas by giving an example. It has frequently been proposed to establish a museum illustrating the adaptation of organisms to surroundings. The aim of this study is to find the physiological laws or the combination of causes which have the effect of causing these adaptations. The classification and arrangement must, of course, be made according to surroundings, in order to show their influence on different kinds of organisms.

An ethnological collection is analogous to this. The objects of study are researches on psychology. The method of researches is a study of the surroundings. The surroundings are physical and ethnical: therefore the arrangement must also be physical and ethnical, as this is the only way to show the single phenomenon in its peculiar character and surroundings.

It has been the tendency of science to confine the domain of deductive methods more and more, and not to be content with arguments from analogy, which are the foundation of most errors of the human mind, and to which may be traced the religious and other ideas of man in a primitive state of culture, and, to a certain degree, even in a state of advanced civilization. Science is constantly encroaching upon the domain of the argument from analogy, and demands inductive methods.

Nevertheless the psychological and scientific value of the argument from analogy cannot be overrated: it is the most effective method of finding problems. The active part it plays in the origin of philosophical systems and grand ideas which sometimes burst upon scientists is proof of this. But, as far as inductive methods can be applied,— and we believe that their domain will continue to increase,— induction must scrutinize the ideas found by deduction. Therefore I should call Professor Mason's system a suggestive one, but not fit for scientific researches, as it does not allow the application of the inductive method.

But even this acknowledgment must be limited. The technological idea, which Professor Mason has made the leading one in the arrangement of the collection of the national museum, is only one side, and a very limited one, of the wide field of ideas which must be leading in a 'psychological museum,' as Mantegazza calls it.

The rattle, for instance, is not merely the outcome of the idea of making noise, and of the technical methods applied to reach this end: it is, besides this, the outcome of religious conceptions, as any noise may be applied to invoke or drive away spirits; or it may be the outcome of the pleasure children have in noise of any kind; and its form may be characteristic of the art of the people. Thus the same implement belongs to very different departments of a psychological museum.

Furthermore, let us inquire what is the psychological principle upon which Mason's system is founded. The leading idea is technology. The foundation of technics is the faculty of acting suitably: consequently the purpose of the implement must be made the principle of division. For in-

stance, all kinds of cooking-pots and other arrangements for cooking would belong to one class. The mere fact that certain pots are made of clay would not justify the establishment of a pottery department. This quality of being made of clay is incidental, and does not agree with the psychological basis.

There is one point of view which justifies a classification according to inventions in a psychological museum. This is the extent to which each invention is used by a people: for instance, in what branches of life pottery is made use of, which may be limited in one tribe, very wide in another. But in this case the purpose of the object will not be the principle of division, but the principal invention applied in its manufacture; and thus the specimens would not be arranged according to Professor Mason's system, objects serving widely differing purposes belonging to one class. Therefore I cannot consider it justifiable to make technology, in the sense Professor Mason does, the basis of arranging ethnological collections.

One reason ought to make us very cautious in applying the argument from analogy in ethnology as well as in other sciences of similar character; biology, for instance. Former events, as I have already said, leave their stamp on the present character of a people. I consider it one of the greatest achievements of Darwinism to have brought to light this fact, and thus to have made a physical treatment of biology and psychology possible. The fact may be expressed by the words, "the physiological and psychological state of an organism at a certain moment is a function of its whole history;" that is, the character and future development of a biological or ethnological phenomenon is not expressed by its appearance, by the state in which it *is*, but by its whole history. Physicists will understand the important meaning of this fact. The outward appearance of two phenomena may be identical, yet their immanent qualities may be altogether different: therefore arguments from analogies of the outward appearance, such as shown in Professor Mason's collections, are deceptive. These remarks show how the same phenomena may originate from unlike causes, and that my opinion does not at all strive against the axiom, 'Like effects spring from like causes,' which belongs to that class of axioms which cannot be converted. Though like causes have like effects, like effects have not like causes.

From my statement it will be understood that I cannot content myself with Mr. Dall's remark, in the letter contained in to-day's issue, that both standpoints contain part of the truth. I have expressed in another place (*Verh. Ges. für Erdkunde*, Berlin, 1886, No. 7) my opinion on Dall's ethnological method, and emphasized, as I have here also, the necessity of studying each ethnological phenomenon individually.

In conclusion I have to add a few words on the practical side of the question upon which Professor Mason and Mr. Dall touch. In regard to this question, I concur with Mr. Dall, and believe that the public will be much more benefited by the tribal arrangement of ethnological collections.

I cannot agree with Professor Mason's proposal of arranging the cases like a checker-board. In ethnology all is individuality. We should be compelled to leave long rows of cases empty, as certain phenomena occur but in very few tribes. It would be almost impossible to show in this way all important ethnological phenomena, the historical development of tribes, the influence of neighbors and surroundings, etc. It is my opinion that the main object of ethnological collections should be the dissemination of the fact that civilization is not something absolute, but that it is relative, and that our ideas and conceptions are true only so far as our civilization goes. I believe that this object can be accomplished only by the tribal arrangement of collections. The second object, which is subordinate to the other, is to show how far each and every civilization is the outcome of its geographical and historical surroundings. Here the line of tribal arrangement may sometimes be broken, in order to show an historical series of specimens; but I consider this latter point of view subordinate to the former, and should choose to arrange collections of duplicates for illustrating those ideas, as it were, as an explanation of the facts contained in the tribal series. Of course, it is generally impossible to do this, on account of the lack of specimens, or, more frequently, on account of the lack of our knowledge; but it is my ideal of an ethnological museum. I wish to state here again that I am not at all opposed to Mantegazza's psychological museum, which will be very suggestive and important for the development of science, but I consider the ethnological museum indispensable for controlling the ideas suggested by the analogies shown in the psychological collection, and as the only means of showing the state of culture of man.

DR. FRANZ BOAS.

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### Correlation of the geological structure of the maritime province of Canada with that of western Europe.

I take the liberty to send a corrected abstract of a paper read by me before the Royal society of Canada, and which may perhaps be of interest to some of your readers: —

As early as 1855, in the first edition of 'Acadian geology,' the author had indicated the close resemblance in structure and mineral productions of Nova Scotia and New Brunswick with the British Islands, and in subsequent editions of the same work further illustrations were given of this fact. Recent researches by Bailey, Matthew, Fletcher, Ells, and others, had still more distinctively indicated this resemblance, as well as the distinctness of the maritime geology from that of the great interior plateau of Canada and the United States. In short, as argued by the author in his recent address before the British association, the geology of the Atlantic margins of America and Europe is substantially the same, and distinct from that found west of the Appalachians in America and in central and eastern Europe. In this fact has originated much of the difficulty experienced in correlating the geological formations of eastern Canada with those of Ontario, of New York and Ohio, as well as similar difficulties in Europe which have led to much controversy and difference of classification and nomenclature. One object of the present communication was to show that the system of classification of paleozoic sediments employed for the interior plateau of the American continent requires very important modifications when applied to the Atlantic coast, and that neglect of this has led to serious misconceptions.

The rugged islands of Laurentian and Huronian rocks correspond in both regions, and show an identity of succession in deposits as well as a synchronism of the great folds and lateral pressures which have disturbed these old formations on both sides of the Atlantic. The Cambrian sediments and fossils as originally described by Hartt, and more recently and in so great detail by Matthew, are in close correspondence with those of Wales, and not identical with those of internal America. The recent paper of Lapworth on the graptolites affords evidence of the same kind, and shows that these were Atlantic animals in their time. It also throws much additional light on the Quebec group of Logan, considered as an Atlantic marginal formation, representing a great lapse of time in the Cambrian and Ordovician periods. The author had long ago shown that the Siluro-Cambrian or Ordovician of Nova Scotia conformed more nearly to that of Cumberland and Wales than to the great limestone formations of Quebec, Ontario, and New York. The upper Silurian also is of the type of that of England and Wales, — a fact very marked in its fossil remains as well as in its sediments.

The parallelism in the Erian or Devonian in both countries is most marked, both in rocks and fossils; and, while this is apparent in the fishes as worked up by Mr. Whiteaves, it is no less manifest in the fossil plants as described by the author.

The carboniferous, in its limited troughs, the character of its beds, and its fossil animals and plants, also points to a closer relationship in that period between the two shores of the Atlantic than between the Atlantic coast and the inland area. This was evidenced by comparative lists of species.

The trias of Nova Scotia and of Prince Edward Island, as the author had shown in 1868 (*Journ. geol. soc. Lond.*), resembles that of England very closely in its aqueous deposits and in its associated trappean rocks.

Beyond this, the geology of the maritime provinces presents no materials for comparison till we arrive at the bowlder drift and other pleistocene deposits. In regard to these, without entering into disputed questions any further than to say that the observations of the author, as well as those more recently made by Mr. Chalmers, conclusively proved that submergence and local ice-drift were dominant as causes of distribution of bowlders and other material, there was evidence of great similarity. The marine beds described by Mr. Matthew at St. John were precise equivalents of the Clyde beds of Scotland, as were the upper shell-bearing beds of Prince Edward Island and Bay de Chaleur of those in Aberdeenshire and other parts of Scotland, and the Uddevalla beds of Sweden. The bowlders drifted from Labrador to Nova Scotia were the representatives of those in Europe scattered southward from Scandinavia, and the local drift in various directions from the hills was the counterpart of that observed in Great Britain. The survival of Mastodon giganteus in Cape Breton, to the close of the pleistocene, is a decided American feature, and so is the absence of any evidence of pleistocene man.

The conclusion of the author was, that, in so far as the paleontology and the subdivisions of systems of formations are concerned, the geology of the maritime provinces is European, or perhaps more properly Atlantic, rather than American, and is to be correlated rather with those British Islands and Scandinavia than with interior Canada and the United States. The latter country, even on its eastern coast, possesses a much less perfect representation of these Atlantic deposits than that in the maritime provinces and Newfoundland; though the recent studies of Crosby, Dale, and others are developing new points of this kind in the geology of New England, and Hitchcock and others have shown that the New Brunswick geology extends into Maine.

The paper further discussed the bearing of these facts on the successive stages of the physical geography of eastern America in the Cambrian, Silurian, Erian, carboniferous, and triassic records.

J. WM. DAWSON.

Montreal, May 30.

## Sea-sickness.

In *Science* for June 3, I find a very interesting review of the medical literature of this subject. It is but natural that means, both prophylactic and curative, should be sought for the benefit of those who find a sea-voyage one of torment rather than pleasure; and the writer has frequently thought that some suggestions derived from the otologist's experience might not be without interest in this connection. Thus, in a considerable experience among persons suffering from aural disease, it has been found that vertiginous symptoms are of frequent occurrence; that the phenomena, in fact, which constitute what is known as 'sea-sickness,' are by no means exclusively experienced by the comparatively few who submit to being tossed about at sea. Indeed, as every one familiar with the subject very well knows, most of the symptoms going to make up this malady are found, in some form or other, to render the lives of a great many persons living upon *terra firma* most miserable. A great many of these individuals experience almost daily, frequently much oftener, sea-sickness without ever going on board ship. The sufferings of these seem to be owing to a faulty condition of the transmitting mechanism of the ear,— defects in respect to which it may be said, that, when normal tension of this portion of the hearing-organ is thus wanting, nearly all the symptoms of sea-sickness may take place from slight though altogether unavoidable, constantly occurring causes. Persons thus affected cannot rise up suddenly from a recumbent position, or otherwise change the pose of the head, without feeling dizzy or staggering when attempting locomotion. Sometimes they experience nausea, and feel faint and otherwise miserable. Or the mere acts of swallowing, yawning, or hiccoughing, whereby intra-tympanal aeration is suddenly altered, may be followed by distressing and sometimes alarming symptoms. The experience of vertiginous phenomena in some form or other, closely simulating what is known as 'sea-sickness,' likewise occurs to the aurally defective in consequence of cerebral concussion caused by impacts of the stapes upon the fluid in the labyrinth, and arising from oscillatory movements of the drum-head when its functions are no longer under the dominance of normal tension. The erratic drum-head, flapping in response to sudden movements of the head, acts of swallowing, etc., would seem to force the stapes into and out of the oval window to an extent far exceeding its physiological limits; and, thus jostled about, the stapes, with each excursion of the drum-head, imparts a shock to the labyrinthine fluid. I am aware that it has long been held by physiologists

the disturbances of equilibrium which I have attributed to concussion, are due to some fic functional disturbance in the semicircular s; but observations drawn from a study of a number having anomalies of the drum of ır, lead me to exclude that theory. It is true e aurally vertiginous just described, that they sent chronic forms of ear-disease, and are usually pathic subjects beyond middle life. But simi-erebral disturbances are not unusual at any acute inflammation of the middle ear. Other s being equal, elderly persons are less ob-us to sea-sickness than the young, since the are much more susceptible to impressions upon ervous system. A friend of the writer who has many ocean-voyages was always a great suf- in this regard in early life, but in after years ienced but little inconvenience in the roughest ıer. On one occasion, however, a berth was as-d him in the after part of a vessel, when, after iencing for a short time the discomforting con-ons arising from the motions of the screw, he ne dreadfully sea-sick while lying in bed. The ss becoming unbearable, he was removed to a amidships, when recovery was almost immedi- It is well known that persons at the beginning voyage may become quite sea-sick, and yet en-recover before landing, — an experience proba-ue to the bracing effect of sea-air. It will be that, regarded from the point of view afforded aurist's clinical experience, nearly all of the omena of sea-sickness may be said to occur on , in consequence of cerebral (labyrinthine) con-on, especially during a state of nervous exhaus- Sea-sickness would seem to be brought about st instances, irrespective of aural defects, from gitation of the cerebro-spinal fluid caused by notions of a vessel at sea, as has already been ibed by other writers. Of course, the con-ve impact from tossing upon the waves is usu-very gentle, but its long continuance finally omes the resisting power of the subject. The may be to make one tired or sleepy only, but ften nausea and dreadful depression are experi-l. As in auditory concussion, such symptoms ense of constriction or of pain and great ten-in the head characterize the more severe cases ıg at sea. It is seldom that the landsman ex-nces the uninterrupted jarring of the brain must be endured at sea; but the writer has many cases where the despondency from the ission of sound even, as well as the other causes e mentioned, was almost as great as could be red.

ere so many conditions favor the occurrence of ckness, it is scarcely to be hoped that any spe-cure will ever be found. In the writer's own ience, the nitrite of amyl, properly employed, ften been found to relieve some of the more reeable symptoms, through its influence on the motor system. SAMUEL SEXTON.

w York, June 8.

## Two balloon-voyages.

e two hundred and fiftieth anniversary of the ling of the city of Providence, R.I., afforded an rtunity for making meteorological observations free air. Mr. Hazen of the signal office, Wash-n, D.C., volunteered his services, and was accepted. On June 24, with a light east-north-east breeze and a gentle rain, the balloon City of Boston left Providence at 5.35 in the afternoon. There were four persons on board, which made it a little crowded; but by leaning out of the basket it was found possible to make the observations, which consisted chiefly in readings of an aneroid barometer, a sling psychrometer, and a watch. The balloon passed over Fishville, Hope, Coventry Centre, and West Greenwich, R.I., and landed in the tree-tops of Voluntown, Conn., at a little after 7.30. The temperature, on leaving the earth, was 60°.2, and at no part of the voyage did it reach a point below 56°.7. The highest point reached was 850 feet, at 6.43. An interesting observation on this voyage was the continual rising and falling of the balloon without the expenditure of ballast. This was partly due to the following: 1. A momentum acquired by the balloon was checked when the drag-rope (about seven hundred feet long) left the earth. Then the balloon began to descend till sufficient weight of the rope on the ground gave it enough buoyancy to rise: this, in turn, was counterbalanced as before. 2. A rise in the balloon was accompanied by a slight fall in temperature: this affected the gas, and gave it less buoyancy. On the other hand, a fall brought the balloon into warmer air, which had a tendency to reverse the former effect.

On June 25 the veteran aeronaut, James Allen of Providence, R.I., and Mr. Hazen, made a voyage, starting from the landing-place of the night previous. The air was perfectly still, and while there was no rain falling, yet the appearance of a heavy fog or mist hung rather low on the hillsides. It was impossible to discern any motion in this mist or in clouds above it.

The start was made at 7.44 in the morning, the air temperature being 61°.3. It was decided to make as high an ascent as possible. The earth was lost sight of at about 1,160 feet. The lowest temperature in the cloud was 58°.3, at 1,670 feet; and from this point it rose rapidly to 65°.6, at 2,450 feet. The highest point reached was 9,780 feet, at 9.18, with a temperature of 48°. Having been out of sight of land more than an hour, and the proximity to sea being rather close, it was deemed prudent at this point to make a descent, which was done with great rapidity; the basket striking the earth with some force, having fallen the 9,700 feet in thirteen minutes, or at the rate of twelve feet per second. The balloon landed within about two and one-half miles of the point from which the ascent of the previous day was made. The temperature at landing was 64°.2, with a gentle north-east wind. At a height of about 8,400 feet the shadow of the balloon was seen upon the clouds, with two rainbow-colored rings about it. Besides the interesting observations of temperature, indicating a rise of over eight degrees in an ascent of eight hundred feet, and showing that just at the top of the cloud the temperature was abnormally high, there were also observations on the direction of the balloon above the clouds. It has been usually considered that above the clouds it is impossible to tell any directions. It was found, on throwing over dried leaves, that they took a definite direction as shown by the compass, and afterward it was found that the balloon was moving in the direction which was indicated by the observer, or slower than the leaves. At the time this observation was made, the balloon was slowly rising, and it

would seem always possible to ascertain the direction under these circumstances. The clouds presented a magnificent spectacle, and seemed like gigantic billows upon a boundless ocean. The sun was very hot indeed, and every effort was made to observe a rising motion in the cloud, but entirely without success. Observations of humidity were made with a sling wet bulb, and the air temperature by a thermometer with a bulb about two millimetres in diameter. All the experiences indicated, that, with modern appliances of drag-rope and anchor, ballooning is entirely safe, and is especially adapted for researches in the free air, which are so very important at the present stage of the science of meteorology.

H. A. Hazen.

Washington, Aug. 13, 1886.

### The freezing-point of sea-water.

I submit the following as the result of several very careful determinations of the freezing-point of sea-water, made at North Bluff, Hudson Strait (latitude 62° 33' 45" north, longitude 70° 41' 15" west).

The situation of the place of observation was within an inlet, at about a mile from its mouth, into which the waters of the strait had unlimited access. A stream twenty feet wide discharged into the inlet at its head, two miles away.

The determinations were made on March 4, 1885, when the temperature of the air was — 12°.6 F., in the following manner: —

A hole about four feet square having been cut through the ice (2.85 feet thick), the water within it was thoroughly agitated by stirring from below, and during the actual operation slightly agitated. The thermometer was held nearly horizontally, the bulb slightly lower than the rest of the instrument, just below the surface of the water. When the ice film began to form at the surface of the water, the corrected reading of the thermometer (Negretti and Zambra, No. C. 3456) was 26°.7 F., at which point it remained stationary; so that, under the conditions I have mentioned, the freezing-point of sea-water is 26°.7 F., — a point very much lower than that usually accepted as its freezing-point, and differing from it in a direction contrary to what we should have expected from the generally accepted assumption that northern waters are of less specific gravity than more equatorially situated waters.

It would have added to the value of the result had I obtained the specific gravity of the water at the time. Later, when I thought to have done so, unavoidable circumstances prevented my doing so.

I might add that a similar determination was made on the opposite shore of the strait with a very closely agreeing result.

W. A. Ashe.

The Quebec observatory, June 7.

### The scientific swindler again.

The following from one of the local papers here will show that the peculiar person who has repeatedly been shown up in *Science* is still at large and at work: at least, I presume he is the same person, since it is unlikely that there is more than one such perverse genius abroad. This time he turns up as a deaf-mute, attached to the Smithsonian, and named 'R. M. Vasile.'

"The Syracuse (N. Y.) *Herald* says, 'A highly educated man, who appeared to be deaf and dumb, and who represented himself to be an attaché of the Smithsonian institution at Washington, came here eight or ten days ago, and succeeded in ingratiating himself into the confidence of Prof. W. A. Brownell of the high school, and of other scientific gentlemen. He gave his name as R. M. Vasile. It took him but a short time to prove himself a master of geology, mineralogy, and chemistry, and his proficiency in those sciences lent color to his representation that he had come here to investigate the rocks and minerals of Onondaga county, and also to get together material for a report on its fishes. Professor Brownell obtained from him for a mere trifle a rare and valuable scientific work, and for one dollar and twenty-five cents got a promise from him, that, upon his return to Washington, he would send on a set of trilobites. Having thus won the confidence of the professor, he began to talk of exchanging specimens with his new-made friend; but his offers excited suspicion, and an inquiry sent by telegraph to Washington brought back the information that Vasile was not in the government's employ. Soon afterward the man disappeared, and he has not been heard from since. He left a board-bill at the Kingsley House, and the impression prevails there that he only pretended to be deaf and dumb. His scheme is apparently to borrow books and scientific specimens in one town, and dispose of them in another.'"

Elliott Coues.

Smithsonian inst., June 8.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 17, 1887.

## ORIGIN OF PUEBLO ARCHITECTURE.

NEARLY twenty years ago, Lewis H. Morgan called attention to the false views of aboriginal American civilization then current. His remarks were intended to apply particularly to the higher cultures of Mexico and Central America, which had always been interpreted through the medium of the glowing accounts of the Spanish conquerors, who saw in every institution some parallel to their own customs. The resulting exaggerated views of Indian culture have thrown a reflected light upon the architectural remains of the south-west. The deserted pueblos scattered over a large portion of New Mexico and Arizona, and extending far into Utah and Colorado, have been linked with the name of Montezuma and the Aztecs by the early pioneers; and the fact that our first knowledge of these remains reached us through such sources doubtless had much influence in fixing erroneous ideas of the ancient builders. These deserted groups of carefully built stone houses, occurring in the midst of desert solitudes, appealed strongly to the imaginations of the early explorers, and stimulated their fancy to reconstruct an elaborate civilization, and to connect the remains, on such slender basis, with their vague notions of the 'Aztecs' and other mysterious peoples. This early implanted bias has caused the invention of many ingenious theories concerning the origin and disappearance of the builders of the ancient pueblos. They have been regarded as a remarkably advanced people, who were swept from the face of the earth by some mighty catastrophe. Their 'buildings' have been said to 'equal any in the United States, if we except the Capitol;' and many more equally absurd extravagances have been uttered in connection with the ruined houses of the ancestors of the present Pueblo Indians.

The work of the bureau of ethnology in our south-western territories has included an examination of a great many of these ruins, and a comparison with the existing pueblos. In connection with the latter portion of the work, many traditions bearing on the occupancy of the ruins by their ancestors have been secured from the present Pueblo tribes, connecting them clearly both with many of the old village ruins and with the cliff-dwellings. A number of these ruins are the remains of villages that have actually been occupied within the historic period. Both the architectural and traditional evidence are wholly in accord in establishing a continuity of descent from the ancient Pueblos to the present time, many of the present tribes being made up of the more or less scattered but inter-related descendants of clans who in former times occupied the villages whose remains are looked upon to-day as the homes of 'Aztec colonies,' etc.

The complete adaptation to the peculiar environment displayed by this system of architecture would indicate that it had long been practised under the same conditions that now prevail in this region, and which still affect the building-methods of the modern Pueblo Indians. A vast number of these pueblos have been constructed of the tabular sandstone found in natural quarries at the bases of hundreds of cliffs throughout these tablelands. This stone naturally breaks into small pieces of regular form, suitable for use in the simple masonry of the pueblos without any previous artificial treatment. The walls themselves give an exaggerated idea of the regularity of the component stones, owing to the care and neatness with which these are placed. The photographs taken in connection with the bureau's work among the ruins show clearly that the material of the walls was not nearly so regular as the appearance of the finished masonry would suggest, but that this finish depended on the careful selection and arrangement of the fragments, with the best face of each stone placed outwards. In the case of some of the best-finished masonry, the photographs indicate that the *core* of the wall has been laid up with the larger and more irregular stones, and the surface afterwards brought to a finish by carefully filling in and chinking the joints with smaller stones and fragments, sometimes not more than a quarter of an inch thick; the whole surface finally being reduced to a uniform face by rubbing the wall with a slab of sandstone.

Although many details, both of construction and arrangement, display a remarkable adaptation to the physical character of the country, yet the influence of physical environment alone would not suffice to produce the architectural type under consideration. Another element is necessary to give point and direction to such influence, in order to develop the results we find. This element was the *necessity* for *defence*. There are many evidences that the Pueblo population of these south-western tablelands have been subjected to the

more or less continuous operation of this *defensive motive* throughout the period of their occupation of this territory. A strong and independent race of people, who had no invasions of stronger foes to fear, would have been necessarily influenced by the environment to the extent of using the exceptional materials offered, and would have progressed in perfecting their lodges; but the motive for building clusters of rectangular cells — the initial point of departure in the development of the pueblo system — would not have been encountered. The crowding of many habitations within the narrow limits of a small cliff-ledge or other restricted site, bringing about the rectangular room-cluster, would most likely have been due to the imperative conditions imposed by this necessity for defence. The character of many sites occupied is not such as would be selected voluntarily by a people in a low grade of culture, and the choice of such places as homes must have been largely compulsory.

The general outlines of the development of this system, wherein the ancient builders were stimulated to the best use of the exceptional materials about them both by the difficult conditions of their semi-desert environment and by the necessity for constant watchfulness and protection against their neighbors, can be traced in its various stages of growth from the primitive conical lodge, and culminating in the large communal village of a single many-storied building, such as we find on the Chaco and also in the homes of some of the present Pueblo tribes. Yet the various steps have followed from a very simple and direct use of such material as was immediately at hand, with gradually improving methods of employing the same, as the experience derived from frequent experiments in building taught them to more fully utilize local facilities, the builders doing the best they could with the materials at hand. In all cases such material was derived from the nearest available source; and the occasional variations in the quality of the finished work were usually due to variations in the quality of the stone near by, or other local features.

The results accomplished attest the patient and persistent industry of the ancient builders, but the work does not display any evidence of great skill in construction or in the preparation of the material.

The same semi-desert environment that furnished such an abundance of material for the ancient builders, also, from its difficult and inhospitable character and the constant variations in the water-supply, furnished the conditions for compelling the *frequent use* of this material; and this was a most important factor in bringing about the degree of advancement in the building art that was attained. At the present day, constant *local* changes occur in the water sources of these arid tablelands, while the general character of the climate remains unchanged.

The pueblo system of construction, then, may be regarded as the product of the defensive motive, operating through an environment that furnished at the same time both an abundance of suitable building-material and the climatic conditions that compelled its very frequent employment.

The comparative abeyance, within the past few years, of the defensive motive, which has been such an important element in the evolution of this building system, has left its impress on the more recent architecture. Even after the long practice of the system has rendered it somewhat fixed, comparative security from attack by their neighbors has caused many of the Pueblo Indians to recognize the inconvenience of a system of dwellings in such large clusters, and on sites difficult of access, while the sources of their subsistence are necessarily sparsely scattered over large areas. This is noticeable in the construction of single houses of small size at quite a distance from the main villages, the motive of greater convenience to crops, flocks, water, etc., being allowed to outweigh the defensive motive.

The greater security of the Pueblos as the country comes more fully into the hands of Americans, has resulted also in the much more careless methods of construction, as well as of arrangement, that characterize the modern examples as compared with the ancient.

It seems altogether likely, that, as time goes on, the system of building a great number of rectangular rooms in many-storied clusters will be gradually abandoned by these people, in the absence of the defensive motive that bound them together and was the compulsory cause of such construction; and a more convenient system of scattered small houses, located near springs and fields, will take its place, thus again returning to a plan of living that must have prevailed at one period in the past evolution of the pueblo, prior to the clustering of a great many rooms into one large defensive village.

The apparently distinct line of separation between the Pueblo Indians and the neighboring tribes gradually becomes less clearly defined as further investigation makes both sides better known and reveals many connecting links. Mr. Cushing's exhaustive study of Pueblo social, political, and religious systems has clearly established their essential identity with those of other tribes. In the sphere of the arts, where the wid-

est discrepancies apparently occur, it is found, that, by tracing the development of each branch of Pueblo art by means of its own internal evidence of the successive periods of growth through which it has passed, we establish its continuous evolution from the simplest beginnings. Mr. W. H. Holmes has clearly shown how the ceramic art of these peoples has naturally developed from the simplest sources, and such as were more or less common to most of the American aborigines in a comparatively low stage of culture. In the case of their architecture, a similar derivation from very primitive forms can be traced. The builders gradually learned to utilize their environment, and perfect the system, until it culminated in the many-storied fortress-pueblo of a single building (such as the ruined pueblos of the Chaco); yet these highest achievements of their art in building contain within themselves a record that these people at one time dwelt in simple circular lodges, such as were common to many American tribes at the period of their discovery.

VICTOR MINDELEFF.

## GEOLOGY OF NEW JERSEY.

UNDER the wise and efficient management of Professor Cook, the very modest annual appropriation of the geological survey of New Jersey is made to yield, year by year, substantial contributions to the geology of the state. The report for 1886 shows that the admirable topographic survey of New Jersey, carried on by the state in co-operation with the U. S. geological and coast and geodetic surveys, is approaching completion. It is being published on a scale of one mile to the inch; and the sheets for the northern part of the state, which were issued some time ago, have been generally accepted as the finest piece of cartographic work, for so large an area, that has been done in this country. They are in constant demand for all the uses requiring an accurate horizontal and vertical delineation of the surface of the country, from laying out water-works and railroads to arranging bicycle tours.

In view of the substantial benefits already accruing from this map before its completion, the wisdom and practical importance of such work cannot be questioned; and it is to be hoped that other states will hasten to profit by New Jersey's enlightened example.

The results of this topographic survey are to be used, on a reduced scale, as the basis of a new geological map of the state.

In the purely geological part of this volume, Dr. Britton's chapter on the crystalline or primitive rocks of New Jersey occupies a prominent place. Three conformable groups are recognized: 1. Massive group, composed chiefly of indistinctly bedded syenitic and granitic or gneissic rocks, and probably equivalent to the Ottawa gneiss or lower Laurentian of Canada; 2. Iron (magnetite) bearing group, embracing a great variety of gneissic and schistose strata poor in white mica, sparry limestone and dolomite, with graphite and serpentine, and bedded deposits of magnetite, franklinite, and other ores (this group agrees well with the Grenville series or upper Laurentian of Canada); 3. Gneissic and schistose group, including biotite and garnetiferous gneisses, mica, hornblende, talc, tremolite, cyanite, chlorite, and other schists; vein granite, bedded diorite, and impure limestone and serpentine. This group resembles Dr. Hunt's Montalban system; and, since it is conformable with the iron-bearing group, the view is advanced that the Montalban may be simply an upper division of the Laurentian. It is interesting to note here that other students of the great Appalachian belt of crystalline strata have been led to propose more or less similar re-arrangements of the crystalline terranes, all of which goes to show the extremely unsettled state of eozoic geology. Dr. Britton introduces a series of sections to show that the same conformable sequence of his three groups obtains in all parts of the highland district; but in view of the massive character of the first group, and the general paucity of outcrops at critical points, this view can scarcely be regarded as definitely established.

It has long been known that the rocks of the highlands, like those of the Appalachian belt generally, are involved in a series of closely appressed folds the axial planes of which are usually inclined at a high angle to the south-east. This report, however, brings out more clearly than ever before, another important feature of these folds; viz., that their axes are not horizontal, but are inclined at an average angle of thirty degrees to the north-east. Since the pitch of the folds is always in the same direction, this involves a series of transverse faults with the uplift on the north-east; and more or less important examples of such faults have already been observed, especially in the iron-mines.

Among the paleozoic strata of this region, none are more interesting, or have proved more puzzling to geologists, than the red conglomerate and associated limestone and slate composing the Green Pond Mountain Range. In the earlier reports of the survey these were referred to the Potsdam, Trenton, and Hudson River groups. The later investigations, however, have resulted in the accumulation of proof, both stratigraphical and paleontological, that these rocks belong much higher in the scale; the red conglomerate being the equiva-

lent of the Oneida, the horizon to which Mather referred it forty years ago, the limestone being clearly of lower Helderberg age, while the slates are shown to belong to the Hamilton group. The Medina, Oriskany, and corniferous groups are also recognized here, and the entire thickness of this great outlier is estimated at 2,750 feet.

Perhaps no formation in this country, equally simple in origin and structure, has provoked so much discussion as the triassic of the Atlantic seaboard. The principal problems which it presents, it is well known, are the monoclinal dips of the strata, and their exact relations to the associated masses of trap. As regards the first, geologists are now pretty generally satisfied that the uniform inclination of the beds is not due to their original deposition on a sloping surface, but to faulting or some similar subsequent disturbance. But, while the studies of Prof. W. M. Davis on the triassic of the Connecticut valley have greatly strengthened the view that the trap sheets of that region are mainly contemporaneous lava-flows, regularly interstratified with the sandstones, Professor Cook is unable to accept this explanation for the trap ranges of New Jersey, holding that they are mainly intrusive and subsequent to both the deposition and disturbance of the sandstone. It is satisfactory, however, to observe that both observers are obliged to qualify the expressions of their views by using the word 'mainly,' which really makes the difference one of degree only; and it may very well be that the trap is more generally intrusive in the one field than in the other, or the exposures of the trap may be more favorable for showing its intrusive aspect in New Jersey and its contemporaneous aspect in New England.

The surface geology is described under the heads of 'glacial drift' and 'yellow gravel.' The former characterizes the surface of the northern quarter of the state, and the latter of the southern three-quarters. The problems of the age and origin of the yellow gravel are discussed at some length, but not satisfactorily solved.

The concluding chapters on economic geology treat of the iron and zinc mines, the cretaceous and tertiary marl-beds, water-supply, and drainage.

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## *CHALLENGER REPORT.*

THREE enormous volumes, aggregating over eighteen hundred pages and one hundred and forty plates, represent the contribution of the Challenger expedition to the scientific knowledge of this attractive group. The reporter, Prof. E. Haeckel of Jena, has devoted some ten years to the study of the collection, and his work forms the largest single report of the whole series.

*Report of the scientific results of the exploring voyage of the Challenger.* Vol. xviii.: Radiolaria. London, Government. 4°.

The Challenger expedition found Radiolaria universally distributed throughout the ocean, and their skeletons nearly equally wide-spread over its bottom; their relative abundance and species differing in different localities, and these differences being correlated with some of the most interesting and intricate problems of general oceanography. It was fortunate, as observed by Dr. Murray, that so distinguished a naturalist should have been willing to undertake a task so laborious and lengthy as the examination of the thousands of minute forms obtained by the Challenger. Professor Haeckel, as will be seen by the most cursory examination of the plates, was extremely fortunate in having the co-operation of Mr. Adolf Giltsch, who made all the drawings of the sixteen hundred new 'species' figured for the report.

The Radiolaria are marine rhizopods, whose unicellular body always consists of two parts, — an outer calymma, which has no nucleus and from which the pseudopodia extend; and, separated from this by a membrane, an inner capsule with one or more nuclei, serving as the special organ of reproduction and general organic centre. Digestion and relations with the outer world in general are attended to by the calymma, and the distinguishing feature of the class is furnished by the constant capsule-membrane separating the two layers. The radiolarians are usually furnished with a skeleton which presents the greatest beauty and utmost variety of form, and is generally composed of silica, or, in certain cases (Acantharia), of an organic substance called 'acanthin.' The individuals are usually single: in only a small minority are the unicellular organisms united in colonies or caenobia.

A systematic catalogue, which forms the termination of the work, and includes all the Radiolaria known up to 1884, contains twenty 'orders,' eighty-five 'families,' seven hundred and thirty-nine 'genera,' and four thousand three hundred and eighteen 'species.' It is hardly necessary to say that these groups have no such value in terms of organization as those in common use by systematists for higher groups of animals. Professor Haeckel's attitude toward systematic biology is analogous to that of an anarchist toward the civil law, and, like that, if adopted by all naturalists, would be likely to result in an indefinite number of individual despotisms. The multiplication of names and groups, apart from their value in relation to other organisms, is pretty well justified by the enormous number of differentiable forms described. It is more than probable, also, in the absence of discriminative natural selection operat-

ing among these multitudinous lowly organisms, that what is recognized among higher animals as specific differentiation, cannot exist, any more than among the foraminifera. So, for the purpose of marshalling, in some sort of order, the chaos of individuals, perhaps nothing better could have been chosen than the arrangement adopted.

The richest source of the material described is the radiolarian ooze of the Pacific Ocean, the remarkable deep-sea mud consisting chiefly of the skeletons of these animals. The tow-net also yielded rich treasures. Professor Haeckel has also included the fruit of his own numerous journeys to the Mediterranean and the eastern Atlantic as well as to the Indian Ocean. Capt. Heinrich Rabbe of Bremen also contributed most important material from the Indian seas; and the collections of Murray and others on various expeditions, such as the Knight-errant and Triton voyages, added to the total. The alimentary canal of various pelagic organisms and even Jurassic coprolites have been laid under contribution. Dr. R. Teuscher of Jena has co-operated with the author in his work: among other things he undertook the tedious micrometric measurements, some eight thousand in number, by which the constancy of the so-called specific forms was endeavored to be tested. The result showed their inconstancy, as might be expected. The conclusion of Professor Haeckel that all other organisms exhibit a similar inconstancy, is, we believe, not in accordance with the general experience of naturalists.

No description can do justice to the wonderful variety and beauty of these minute creatures, and for fuller realization the reader must turn to the plates of what we may properly call this stupendous undertaking.

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## *FOURTH ANNUAL REPORT OF THE BUREAU OF ETHNOLOGY.*

THE present volume, which has just been issued, contains the report of the director for 1882–83, and some papers of eminent value. The latter must be reviewed separately, and we shall confine ourselves to some remarks on Major Powell's report. The broad basis on which the researches of the bureau are carried on is due to him, and ethnologists must be thankful for his encouragement of special lines of study — for instance, Mallery's researches on sign-language and pictography — and of special researches on certain groups of tribes, which cannot be made without the assistance and support of a powerful institution. In this respect the work of the bureau is of the greatest value, as it puts an end to the dilettanteism which formerly obtained in American ethnology. Major Powell's attempts to gain the co-operation of scientists not officially connected with the bureau cannot but exert a wholesome and encouraging influence on American ethnology. Numerous valuable researches which are included in the reports of the bureau and in the contributions to North American ethnology are proof of this.

Another important feature of the work of the bureau is the broad and systematic plan by which Major Powell carries on the researches of the bureau. He keeps three publications particularly in view. His remarks on this subject are of great interest. He contemplates the publication of, "1°, a series of charts showing the habitat of all tribes when first met by Europeans, and at subsequent eras; 2°, a dictionary of tribal synonymy, which should refer the multiplied and confusing titles, as given in literature and in varying usage, to a correct and systematic standard of nomenclature; 3°, a classification, on a linguistic basis, of all the known Indians of North America, remaining and extinct, into families or stocks.

"The order of possible preparation of these publications is the reverse of the above. The charts cannot be drawn until the tribes, as villages, confederacies, and leagues, shall have been resolved from multiplicity and confusion into identification and simplicity. The linguistic classification precedes the whole of the work, and the difficulties attending it have at times suspended its satisfactory progress until expeditions of research had been sent forth to clear up the obstacles of uncertainty and ignorance. Numerous publications of ethnologic charts of partial synonymes and of tentative classifications have appeared from various sources, but all have been imperfect and more or less erroneous. The personal attention of the director and of all the officers and employees of the bureau has been steadily directed, in addition to the several branches of work from time to time undertaken, to presenting them in a proper form. The labor and study required have been beyond expression, but may be partially indicated by the fact that, apart from the linguistic and sociologic problems involved, the mere mechanical compilation has produced over twenty thousand cards of synonymy. The present condition of this interconnected work is encouraging." The publication of this material will be the first sound basis of continued researches on American ethnology. We do not enter into the details of the field-work done by the bureau, as during the subsequent years much additional work has been done, and has become known in its outlines. In this respect it must particularly be regretted that these reports, like most other government publications, are not sooner issued.

We heartily concur with Major Powell, in his remarks on the undesirability of amateur collectors and travellers. Unfortunately, many explorers are so little conversant with the elements of ethnology, and so little able to consider natives from any other point of view than that of our own civilization, or to enter into their methods of thinking, that they do more harm than good. Any one who has studied ethnological literature knows how true this is. It is an underestimation of private work, however, when Powell says, "Experience has shown that individual travellers, unguided and without common system, have failed to obtain the best results in examining members of native tribes both as individuals and as aggregations." This affirmation is opposed to the encouragement of private researches, which Powell has so successfully made the policy of the bureau. We do not doubt that scientists who are supported by the moral influence and the means of the bureau have better chances of success than those who travel without such support; but, as the bureau of ethnology is not able to carry out all the field-work that is necessary and desirable, researches of scientists undertaken outside of the systematical plan of the bureau ought to be welcome.

We consider the plan by which the researches of the bureau are carried on a very successful one. The principal idea is that the phenomena of ethnology and archeology must be studied from a common point of view, and that a knowledge of the former is indispensable for understanding the latter, and that the supposition of sudden cataclysms, instead of that of a continuous development, is only justified where clear evidence of the occurrence of such phenomena can be shown. The work of the bureau is of great importance not only for science, but also for a successful method of making the Indian a useful member of the state and of human society. We cannot press upon him our civilization. A thorough knowledge of the Indian character is necessary to reach satisfactory results in this line. Both scientists and philanthropists must wish that the work of the bureau be carried on as vigorously as possible, and that its operations ought not to be hampered by lack of means for extensive field-work and publications.

DR. FRANZ BOAS.

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## *THE ROTIFERA.*

IN our previous notice of this work (vol. vii. p. 402) we based the favorable judgment, which we then expressed, upon the first two parts. We have now before us the completed work, the examination of which strengthens our previous favorable opinion. The authors are not of those whose studies are prompted by an insatiable eagerness for knowledge, but rather, it appears to us, are they lovers of Nature, who seek the closest intimacy with her to gratify their affections. They are pleased to quote upon the reverse of their titlepage Shelley's lines:—

> "Those viewless beings,
> Whose mansion is the smallest particle
> Of the impassive atmosphere,
> Enjoy and live like man."

We do not mean that the characterization of the species is vague and dreamlike. It would be difficult for a biologist to determine the systematic position of Shelley's 'viewless beings' from the poet's description; but Mr. Hudson's are scientifically exact, although they are rendered interesting by the addition of something of the literary flavor that alone is present in Shelley's beautiful inexactitude. It is this combination of qualities which imparts a double merit to Hudson and Gosse's monograph, and renders it acceptable and welcome alike to the professional and to the amateur naturalist.

The work is a valuable contribution to science, as every conscientious monograph must be; for it is indispensable to progress that we should have from time to time, in regard to a given subject, a comprehensive presentation of the accumulated knowledge. A monograph of the Rotifera was very much needed, for it is twenty-five years since the revision by Dr. Arlidge. To execute the task worthily, it was necessary that the many, by no means always rare, species which had remained undescribed should be properly investigated, so as to be included in the monograph. This laborious undertaking the authors have accomplished. Their work contains more than one hundred and twenty species which were unrecognized when Dr. Arlidge wrote: nearly all of these have been added to science by the authors themselves, some eighty of them by Mr. Gosse.

When Mr. Hudson passes beyond his *rôle* of observation and description, and occupies himself with problems of morphology and of the affinities of the Rotifera, he is less fortunate than we could wish. Thus, he says in his preface that his discovery of the remarkable Pedalion mirum "has put beyond question the fact that the Rotifera, in one point at least, are closely linked to the Arthropoda." Now, Pedalion is a true rotifer, which has six limb-like appendages, two of which are on the median line (one being dorsal, the other ventral), and four of which are lateral. The limbs have terminal bristles. These appendages impart, in

*The Rotifera; or, Wheel-animalcules.* By C. T. HUDSON, assisted by T. H. GOSSE, F.R.S. Parts iii.–vi. London, Longmans. 8°.

fact, something of a Nauplius-like appearance to the animal; and, inasmuch as the Nauplius is the larval stage of certain Crustacea, Pedalion may be said to offer some resemblance to an arthropod. It must be remembered that arthropod limbs are always symmetrically disposed, and never occupy a position in the median line, except as a secondary modification resulting from the fusion of two originally distinct limbs into one median structure; as occurs, for example, in the Labium. Moreover, arthropod limbs are the appendages of segments, and are arranged in serial order lengthwise of the body and by segments. In the Rotifera, on the contrary, there is and can be no such arrangement, because there are no segments. In fact, we must interpret the similarity — which, after all, is imperfect — of the limbs of Pedalion to those of the Nauplius as an analogy, and not as an homology.

So, much may be said to indicate the limit beyond which the special merits of the work do not extend; but within those limits we find a great deal of the best excellence, which abundantly justifies our congratulating the authors upon the completion of their capital and thorough treatise.

## LETTERS TO THE EDITOR.

[Continued from p. 592.]

### The cause of consumption.

THIS subject is of such great importance not only in the prevention but also in the treatment of the disease, that I feel sure you will permit me to reply to the important objection raised by 'Medicus' to my theory of consumption. In science we proceed from the known to the unknown. Now, we know that the constant inhalation of small particles produces consumption, and that they evidently reduce the breathing capacity; and we have produced experimentally the disease in animals by simple confinement, which also reduces that capacity. Further, I have produced consumption by reducing the breathing surface of the lungs below a certain point, and I have searched the records in vain to find a case of consumption in which such conditions were not present. The tribes that are absolutely free from this disease are known to live under conditions that tend to develop the lungs; and we see the introduction of civilization amongst them — that is, of conditions that tend to reduce the breathing surface — is followed by the introduction of that disease. But, says 'Medicus,' — and I have had the same objection here, — that is because the bacillus has been introduced. I reply, apply the same process of examination to the bacillian theory, and it fails at the very beginning. Koch's important experiments — they mark an epoch in the knowlege of life — resulted in an apparent affirmative and an absolute negative. In some animals he induced consumption, in others he did not. What is the difference between the two classes of animals? The former evidently had been, and were, subjected to conditions that tend to reduce the breathing capacity; while the latter had not been, and were not, subjected to such conditions to the same extent. What followed the stoppage of the ventilating shafts of several wards at Brompton, an outbreak of consumption? No. Erysipelas. In civilization we do not know where the bacillus, so called, tuberculosis is not, and I am curious to see who will prove their absence amongst the tribes that are yet free from consumption. And while the germicide treatment of the disease has admittedly failed, that based upon this theory has, both in the experiments and in the four cases to which it has been applied, proved completely successful.

G. W. HAMBLETON.

London, May 25.

### Scandinavian studies in the United States.

The readers of *Science* had their attention directed to this subject in a recent article written by Daniel Kilham Dodge; but the writer of that article, unwittingly I suppose, does injustice to the Scandinavians in this country as well as to the work that is so nobly being carried on by them. He also omits a prominent university in the north-west which is trying to do what he thinks ought to be done by many American colleges. As to the success of such efforts, his historical account has important lessons.

He states that there is "a population of 107,768 Scandinavians in Minnesota, and there is not a college in which the parent tongues of this great mass of people can be studied."

This might convey a wrong impression about the Scandinavians, if the readers of *Science* were not informed that during the year 1886 between seven and eight hundred students attended the Scandinavian institutions of Minnesota. True, these institutions are not as yet complete colleges in the American sense of the term, but the day is not far distant when some will be an equivalent. Their object is not degrees, but qualifications. These people have been nurtured by European universitiy principles, and with university men in their midst: they are not slow in fathoming the shallowness of a great deal of the American college-training.

Gustavus Adolphus college, situated at St. Peter, Minn., is a flourishing institution with two hundred students, that is lacking only one year of having a four-years' collegiate course. One-half of the professorships are held by men who are not Scandinavians, but Americans educated in eastern American colleges. Latin, English, German, mathematics, and natural sciences are taught by these professors. Augustana college, Rock Island, Ill., is another and older institution, supported by the Swedes, which has been graduating class after class for a period of ten years. Persons holding a diploma from this latter institution are admitted into the University of Upsala without examination. A goodly number of the professors are also American college-bred men. Within recent years a most promising educational work was begun by the Swedes at Lindsborg, Kan. During the past year, over three hundred students attended the different departments of Bethany college and Normal institute, and at the coming commencement they will dedicate an elegant and large college-building.

The Swedes and the Norwegians are alive on educational matters, and their influence is and will continue to be felt in this country. They are Swedes

and Norwegians, and no one can blame them if they desire their children to be educated in a way that they can appreciate it; and, if the Americans can not and will not do it, they will and must do it. As a rule, they are not opposed but glad to have their youth learn English; but they also wish them to know something more, especially the language, literature, and history of the fatherland. The complaint made against them often comes from denominational headquarters, because they cannot proselyte them fast enough. The Scandinavians are Lutherans, and they will resist any and every attempt that is made to rob them of the faith for which Gustavus Adolphus fought and died. Allow them the religious liberty of which we boast as Americans, and they will be Americans too. J. P. UHLER.

St. Peter, Minn., June 2.

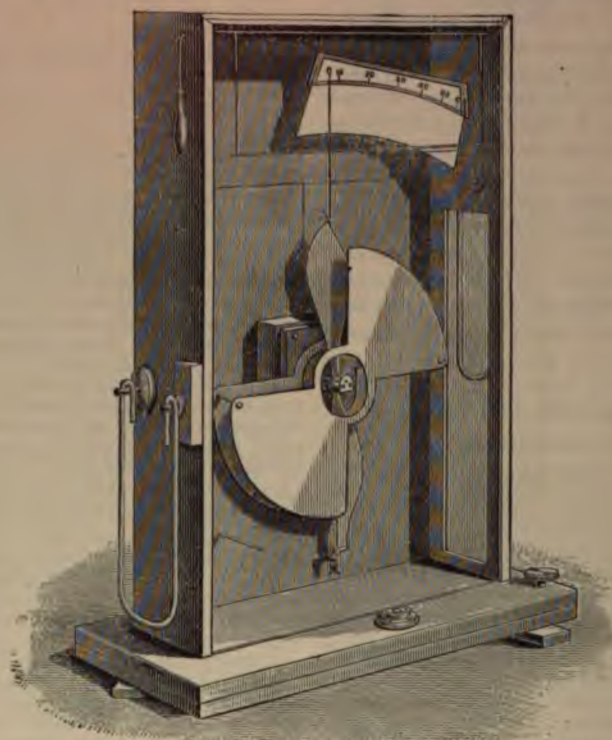
### Thomson's electrostatic voltmeter.

Respecting your inquiry as to the merits of the Thomson electrostatic voltmeter, I must say that I have made great use of it during the last year, and am very much pleased with its performance. It has the disadvantage of not being very portable, and I fear that the wood of which the enclosing box is formed will go the way of all European woods in our climate. I begin to see evidence of warping now, which will make it necessary to re-examine the scale of the instrument.

The instrument will, however, hold its charge remarkably well, evidence of which I have recently had, in which I have used a large battery of Leyden jars as a source of electricity.

The instrument measures between four hundred and ten thousand volts, and is exceedingly useful in connection with the Holtz machine and other high-tension sources. F. E. NIPHER.

St. Louis, June 3.



THOMSON'S ELECTROSTATIC VOLTMETER.
(Reproduced by permission of James W. Queen & Co.)

THE report recently issued by the geological survey of Kentucky, on the geology of Elliott county, discusses the coal-measures of that region, and especially the massive conglomerate, which, along certain uplifts, has been deeply trenched by the streams, the vertical walls of the narrow and exceedingly picturesque gorges ranging from 75 to 175 feet in height. We also find here full accounts by Messrs. Crandall and Diller of the trap dike of Elliott county, which is noteworthy as being the only mass of eruptive rock yet discovered in Kentucky, and of the 'interesting possibilities' in the way of diamonds suggested by Professor Lewis. But, although this peridotite is similar to that so closely associated with the diamonds in South Africa, Mr. Diller finds no facts which would warrant a persistent search for the gems in Kentucky.

SCIENCE.

FRIDAY, JUNE 24, 1887.

## COMMENT AND CRITICISM.

AN INTERESTING CASE of the failure of heredity is shown in the Greenough family, of which Horatio Greenough, one of our earliest sculptors, whose letters have just been published by Ticknor & Co., is a well-known member. Although several of Mr. Greenough's brothers and sisters displayed an interest in and capacity for art, yet no explanation for this love and devotion can be found in either of the parents, nor in the ancestors so far as known. The father was 'a sensible, practical, honorable man' from Wellfleet, on the Cape. The grandfather had a collegiate education and good talents, and died at the age of thirty-nine. The mother lived to the age of eighty-nine, was passionately fond of nature, and had a facility for writing, and love for reading, but neither knowledge nor appreciation of art. Of the brothers and sisters of Horatio Greenough, of whom there were eleven, John, the oldest, was born in 1801. He showed when young a love of design, and supported himself for some years in London by painting. Alfred, the fourth son, was interested in art, but never studied it. He afterward entered into business. Richard Saltonstall, the youngest of the sons, born in 1819, distinguished himself at an early age by a portrait bust of Prescott the historian, a fine bronze group of a shepherd-boy and eagle, and the statue of Franklin in School Street, Boston. He has lived in Rome for many years, where his later works are well known. One of the daughters also possessed all the natural gifts requisite for an artist.

THE INCREASING NUMBER of series of monographs on special topics must have attracted the attention of all those who possess any acquaintance with current literature. We have an American science series, a set of science primers, several sets of literature primers, historical monographs, economic papers, and so on. The development in this direction is a perfectly natural one, and one which results from the increasing specialization in study. It is impossible any longer for even the well-informed man to follow methods and details: he must rest content with results, and even those concisely stated. This multiplication of small books on great subjects has been deprecated, we know, but, as it seems to us, on untenable grounds. When Huxley writes on science in general, Walker on political economy, Geikie on geology, Martin on biology, and Young on the sun, we may rest assured that the results will be beyond criticism.

Within a few days, two additions to these series, both of them extremely important, have been announced. The first comes from the faculty of political science of Columbia college, — a body which has already placed the community under obligations to it not only for its admirably organized and conducted course of study, but for its invaluable *Political science quarterly*. Each of the professors in this school has undertaken the preparation of a work on his own subject; and the series will cover the whole field of political science proper, as well as the allied subjects of public law and economics. Nine volumes are in course of preparation, and in each the historical and comparative method will be followed. The nine volumes mentioned are 'Comparative constitutional law and politics,' by Professor Burgess; 'History of political theories,' by Professor Alexander; 'Historical political economy,' by Prof. Richmond M. Smith; 'Comparative constitutional law of the American commonwealths,' by Mr. F. W. Whitridge; 'Historical and comparative science of finance,' by Dr. E. R. A. Seligman; 'Comparative administrative law,' by Mr. F. J. Goodnow; 'International law,' by Professor Dwight; 'Comparative jurisprudence,' by Prof. Munroe Smith; and 'Literature of political science,' by George H. Baker. The first of these volumes will be issued in the autumn.

The second announcement to which we refer will probably attract even more wide-spread attention than the first. It is to the effect, that, recognizing the lack of the accurate and scientific treatment, in an accessible form, of educational and pedagogic questions, the Industrial education association of this city will commence in the au-

tumn the publication of a series of educational monographs under the editorship of the president of the association, Dr. Butler. The papers will treat of various educational topics, historically and critically; and the most prominent educators, both in this country and in Europe, have promised contributions. It is expected that the first monograph will be from the pen of President Gilman of the Johns Hopkins university. The arguments in favor of industrial education and statements as to its proper organization and development will occupy a prominent place in the series, but not at all to the exclusion of other topics. We have heard both of these announcements with much pleasure, and particularly the latter, for it means that the teachers of the country will be able to obtain the opinions of responsible educators on current questions readily and at small cost. It is understood that this educational series will closely resemble in form and style the 'Historical studies' issued from the Johns Hopkins university, under Dr. H. B. Adams's editorship.

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AN UNEXPECTEDLY rapid growth in the numbers of students registering in the Cornell university for the Sibley college courses, in the past two years, and since their establishment on their present basis, has already crowded that institution to its utmost capacity in many directions, the number in the college having already approached, within twenty-five, that considered the maximum which can be accommodated in the existing buildings. A new building now in progress, under contracts made by the Hon. Hiram Sibley, and which will be presented to the university, will, however, increase the total space available next year by fifty per cent, and will bring the total number, as a maximum, when all classes are filled on the new basis, up to three hundred.

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## DISTILLERY-MILK REPORT.[1] — III.

IN response to our circular, a number of letters of interest have been received, which we reproduce below: —

[Prof. H. P. ARMSBY, agricultural experiment-station, Madison, Wis.]

I do not think that there is any good evidence of any direct injurious effect of the swill upon the milk if used in a reasonably fresh state, and as a supplementary food; that is, as part of a properly compounded ration. Used too exclusively and in too large quantities, it is liable to produce disease in the cows, and thus to injure the milk. The great danger connected with the use of distillery swill, however, arises from the fact that it furnishes a most favorable medium for the growth of all sorts of micro-organisms. Unless the greatest care and cleanliness are observed about the stable, portions of the swill are almost certain to accumulate in out-of-the-way places, and serve as breeding-places of these organisms, whose spores contaminate the air of the stable, and almost necessarily infect the milk. While, therefore, I believe that milk of good quality, both as to composition and healthfulness, may be produced when distillery swill is fed, I question whether such will be its quality in the majority of cases: at least, there is always danger that it will not; and as regards that portion of the milk-supply of cities drawn from the small dairies in the outskirts and in the neighborhood of distilleries, which are often in the hands of ignorant and unscrupulous men, the danger is a very grave one. Two valuable papers in the *Milch Zeitung* for 1886 (Nos. 45 and 46) discuss the healthfulness of distillery swill quite fully: the first of them, by Professor Kirchner of Halle, takes substantially the ground that I have indicated above; the second, by a practical farmer, is more favorable to its use. These are all the references I have now at hand.

[E. L. STURTEVANT, M.D., New York agricultural experiment-station, Geneva, N.Y.]

In response to your circular request of May 12, 1887, I would say that we have had no experience at the New York agricultural experiment-station with the feeding of distillery waste or distillery swill. In 1884, however, we had a very carefully planned and executed experiment upon the feeding of brewers' grains in an acid and putrefactive condition. The conclusions derived, while against injudicious feeding, were in no sense detrimental as regards the taste, flavor, appearance, keeping-quality, or composition of the milk, nor as between the hay-fed or the brewers'-grains-fed milk, nor as between the milk from the experimental cows and that yielded by the remaining cows of the herd, all of which is fully reported in our 'Third annual report,' pp. 49–59.

A further general experience with experimental feeding leads me to the belief that oftentimes the sanitary condition of the cattle under objectionable feeding has more to do with unhealthfulness in the milk-product than the actual food used. In support of this latter view, I would say that in 1869 I visited the dairy herds in the vicinity of Glasgow, Scotland. I found the prevalent custom among the farmers was to haul distillery swill daily to their farms, and to feed it to the milch-

[1] Continued from p. 581.

cows which furnished the milk-supply to the city. In the excellent sanitary condition of the cattle to whom this distillery slop was fed, we had a remarkable contrast to the asserted method of feeding in the stables attached to distilleries. At that time the milk-supply of Scotland was supposed to be of very superior quality as compared with that of ordinary city supplies; and I certainly could find no fault with the milk drank at the hotel tables, with that observed in the hands of the distributer, or with the milk observed in the byre at milking-time.

I may perhaps be allowed to assume to myself sufficient experience to be justified in offering the opinion that it is probable that a discussion of the sanitary surroundings of a herd is of more importance than that of the character of the food used, including in the term 'sanitary conditions' the effect upon the health of injudicious feeding. In support of this view, I would refer to experiments reported in the 'Fourth annual report of the New York agricultural experiment-station, for 1885,' pp. 16–34, wherein the adding of vinegar to food in condimental quantities was followed by increased appetite in the animals, and produced no observable detrimental effect upon the products. This conclusion is corroborated by various experiments with ensilage (always in an acid condition), wherein it was found that when ensilage was used in condimental quantities there was increase of appetite and no injurious effect upon product. On the other hand, when ensilage was fed exclusively, there was perhaps a detrimental effect to be observed upon nutrition, apparently coming from the inability to eat a sufficient food-supply, and no detrimental effect to be observed in the milk yielded.

My opportunities have not been such as to enable me to form a judgment in regard to the healthfulness of milk, for such data can only be obtained through actual trial and experience; but if testimony has any weight, the using of milk from distillery-fed animals, including in this term not only the food-supply but the unsanitary condition, must be extremely detrimental to health. We hence have offered in your questions two distinct problems: 1. The practical problem concerning the use of distillery waste as used in connection with unsanitary conditions; 2. The scientific problem as to whether this assumed injurious condition of the milk is derived primarily from the food, or from the conditions under which the food is fed, including the problem of injudicious feeding.

[H. C. DUNAVANT, M.D.]

My opinion, based on chemical and physiological reasoning, is, that swill-fed cows could not give wholesome food in the way of milk.

[S. W. ABBOTT, M.D., secretary Massachusetts state board of health, Boston, Mass.]

Chemical analyses will not settle the question. There can be no doubt that milk may be produced which is unfit for use, and at the same time may contain an unusually large amount of milk solids. Experiments in Hamburg in regard to the milk-supply from certain model stables or dairies have shown this to be true. My opinion as to the wholesomeness of distillery swill as food for cows is that it is bad. The principal nutritious portion of the grain has already been withdrawn for the purpose of supplying the necessary elements for conversion into alcohol in the product of the distillery, and the cows are thus defrauded of that which is their natural food.

### *Analyses.*

In answer to the question, What analyses can you give of milk obtained from cows fed on distillery swill? the following replies were received: —

[S. RATTON PERCY, M.D., New York academy of medicine, 1858.]

| | From one of the fattest cows in a distillery stable. | From mixed milk of 4 cows just after milking. | From same stable; milk taken from cans. | From another stable; milk from cans. | From another stable; milk from 4 cows just after milking. |
|---|---|---|---|---|---|
| Solid particles..... | 142.0 | 130.0 | 131.0 | 132.0 | 133.0 |
| Water.............. | 858.0 | 870.0 | 869.0 | 868.0 | 867.0 |
| Butter............. | 44.0 | 35.0 | 31.0 | 30.0 | 34.0 |
| Sugar............... | 18.0 | 15.0 | 17.0 | 18.0 | 18.0 |
| Caseine, or curd.. | 66.0 | 68.0 | 70.0 | 70.0 | 69.0 |
| Saline matters.... | 14.0 | 12.0 | 13.0 | 14.0 | 12.0 |
| | 1000.0 | 1000.0 | 1000.0 | 1000.0 | 1000.0 |

[Professor SIMON, Baltimore, Md.]

Of many samples of milk examined, I will give here the average result of six samples; specific gravity, 1.029: —

| | |
|---|---|
| Fat.................................... | 3.77 |
| Caseine.................................. | 4.44 |
| Milk-sugar.............................. | 4.56 |
| Ash...................................... | 0.76 |
| Water.................................... | 86.47 |
| | 100.00 |

[Professor DOREMUS.]

| | |
|---|---|
| Solid particles | 141.4 |
| Water | 858.6 |
| Butter | 44.2 |
| Sugar | 17.9 |
| Caseine | 70.8 |
| Saline matters | 8.5 |
| | 1000.0 |

[E. H. BARTLEY, M.D.]

Milk from two cows at the Blissville swill-stables in 1879, obtained by myself and personally analyzed, gave the following results: —

| I. | | II. | |
|---|---|---|---|
| Water | 89.21 | Water | 89.14 |
| Fat | 1.37 | Fat | 1.23 |
| Sugar, Caseine | 8.80 | Sugar, Caseine | 8.95 |
| Ash | .62 | Ash | .68 |
| | 100.00 | | 100.00 |

Not more than five per cent of thin cream by volume in either specimen; reaction acid; under microscope, fat-globules scant, small, and aggregated; some colostrum-like cells and particles of epithelium.

*Sanitary ordinances.*

From the answers received, it appears that sanitary ordinances exist in Brooklyn, section 45 of Sanitary code, and in New York, sections 29, 45, 186, and 207 of Code, prohibiting the feeding of distillery swill to milch cows, and the sale of milk from animals so fed. In New York state the same practices are prohibited by chapters 202, Laws of 1884, and 183 of Laws of 1885. In New Jersey, chapter 82, Laws of 1882, prohibits substantially the same. There is said to be a prohibitory law to the same effect in Illinois. The sale of milk from cows confined in distillery sheds, and fed on distillery slops, is prohibited in Chicago. In Massachusetts the sale of milk from cows fed on the refuse of distilleries is prohibited (Chapter 57, sections 5 and 9, of the Public statutes of Massachusetts, as amended by chapter 318 of the Acts of 1886).

[*To be continued.*]

## EXPLORATION AND TRAVEL.

### *Asia.*

MESSRS. BONVALOT and Capus, who are making an attempt to reach India, starting from Fergana, by way of the Alai Mountains and the Pamir Plateau, had reached on March 15 (*Bull. soc. géogr.*, No. 10) the pass of Taldyk, a few days' journey north of Kara-Kul, which is situated in the northern part of the Pamir. Their journey is considered extremely difficult, on account of the severity of the climate, the hostility of the natives, and the difficult roads.

Mr. Carey has continued his interesting journeys in Central Asia. The latter part of the winter of 1885–86 he spent in Chelik, near Lob-Nor. About May 1 he went south, in order to explore the northern part of Tibet. For this purpose he had to cross the Altin Tag and Chamen Tag. Having passed these ranges, he reached the foot of a high chain, which is probably the true Kuen Luen. Here his guides failed to find a pass by which it was possible to cross so early in the season, and he had to travel a considerable distance eastward, through barren and difficult country, until at length an opening was found leading to the valley of the Ma Chu, the head source of the Yang-tse-kiang, which was visited by Prejevalsky in 1879. Want of supplies compelled him to turn north, and he spent some time exploring the district of Tsaidam, which is situated between the Altin Tag and Marco Polo range. In the autumn he struck north, and, after crossing the Gobi, reached Urumchi in the Tien Shan, now the capital of Chinese Turkestan. Here he was well received by the Chinese governor, and despatched to Yarkand, where he arrived early in the present year, and whence a start was made on March 7 for Ladak. It appears that he went chiefly over Prejevalsky's ground. The high chain south of the Chamen Tag, reached by him, are the Columbus and Marco Polo mountains of Prejevalsky. His journeys in Tsaidam are new, while on his way north he followed Prejevalsky's route. The results of this journey, nevertheless, will be of great importance.

### *Africa.*

The *Scottish geographical magazine* for June contains an interesting account of an exploring trip to Mvutan Nsige by Emin Pasha. His remarks on the formation of the lake are of great interest. He describes the mountain-ranges bordering it, and the alluvial deposits on its western coast. Land is forming rapidly on the west side of the lake, it appears, while the mountains on the east side rise steeply from the water. The lake is described as very stormy, the winds blowing with great force up and down the valley. Emin has made two other excursions on the lake since this paper was written; and the following extracts from a letter, which are published as an appendix to the paper, give the chief results of his work. He writes, "The chief result of my work is the

discovery of a new river, which flows from the Usongora Mountains. It is of considerable size, and flows into the lake at the south. The river, which is called 'Kakibbi' by the Wasongora, and 'Duéru' by the Wamboga, has, near its junction with the lake, a large island. It is, however, on account of the many cataracts, very difficult to navigate; but, on the other hand, it pours into the lake throughout the whole year a large volume of water. Upon its banks, at a short distance from the lake, is the town of Hamgurko, where a considerable quantity of salt of a superior quality is found. The Kakibbi, or Duéru, forms the boundary between the Muënge district of Unyoro, which lies to the east, and the country of Mboga, which lies to the west. The country of Mboga is inhabited by a people who speak a language that appears to be only a dialect of the Kinyoro. To the west-north-west and north, Mboga is bounded by Lendu, a country which lies behind the mountains bordering on the Albert Lake. To the west I found a country inhabited by tribes I take to be Iddio (A-Sandeh). To the south-west I was told there was a large river, on the banks of which there is a colony of Akkas, called 'Balia' by the Wanyoro people. They, however, call themselves, in their own language, 'Betua.'"

This information on the country Stanley has to traverse on his way to the Mvutan Nsige is of great interest. Usongora will be found as the name of the island in the Muta Nsige on our map of Central Africa. The great river to the south-west referred to by Emin must be one of the Kongo tributaries. His remarks show that the Sande (Niam-Niam) tribes extend far south-east. The name 'Betua,' by which the dwarfish Akka call themselves, reminds us forcibly of the name 'Watwa,' or 'Batua,' by which, according to Wolf, all the dwarfish tribes of the southern Kongo call themselves. The country of Lendu is difficult to reach from the Mvutan Nsige, the hills on the west side of the lake being very steep.

Stanley's expedition arrived at Leopoldville on April 20 (*Mouv. géogr.*, June 5). It took twenty-seven days to accomplish the distance between Matadi and Stanley Pool, which is five days more than Stanley had estimated. The scarcity of food in this country was the principal cause of the delay. The expedition camped nine days at Leopoldville. Here Stanley obtained for his enterprise the steamers Peace of the Baptist mission, the Henry Reed of the Livingstone mission, the Florida of the Sandford expedition, and the Stanley of the Kongo association. On April 29 every thing was ready, and the expedition embarked. It is believed that Stanley Falls was reached about June 5.

## *HEALTH MATTERS.*

### *Baldness.*

DR. G. T. JACKSON read a paper recently before the New York county medical society on baldness and its treatment. He described four varieties of baldness, or alopecia: 1°. Alopecia adnata, the congenital form; 2°. A. senilis; 3°. A. prematura; 4°. A. areata. A. senilis is that form which occurs in old age, or after the age of forty-five, and is often preceded or accompanied by grayness of the hair. Its cause is a gradual hardening of the subcutaneous tissues of the scalp and a diminution of blood-supply, followed by an obliteration of the hair-follicles. It is but one expression of that general lowering of nutrition incident to advancing years. When the scalp is atrophied, nothing can be done in the way of treatment, but prophylaxis may do a great deal in postponing those changes. A. prematura is that form of baldness which occurs before the forty-fifth year. Of this there are two varieties, — the idiopathic and the symptomatic. The former occurs most commonly between the ages of twenty-five and thirty-five, and is not due to any antecedent or concomitant disease. It differs from the senile form in occurring at an earlier age, and in being unaccompanied by other signs of diminished physical vigor, such as loss of teeth, dulness of sight and hearing. The chief cause of this variety is heredity. Every one has known of families in which the fathers and sons have become bald at a very early age. Another cause is improper or deficient care of the scalp. It is a common practice for men to souse the head daily in water. Ellinger has noted this habit in eighty-five per cent of his cases of baldness. Thinkers and brain-workers are very often bald. Eaton found, in the audiences attendant upon churches and operas in Boston, that from forty to fifty per cent of the men were bald; while in cheap museums and at prize-fights the percentage was only twelve to twenty-five. Stiff hats may cause baldness by compressing the arteries that supply the scalp. Tight and unventilated hats make the scalp warm, and cause it to perspire, thus favoring baldness. King says that baldness of the vertex is due to compression by stiff hats of the arteries which supply that part. The little tuft of hair often observed on the top of the forehead is nourished by arteries which escape pressure. That women do not become bald so often as men is probably because they preserve the cushion of fat under the scalp longer than men do. They do not wear their hats as much as men; nor are these so close-fitting, or made of such impermeable material. They also

give more attention to the hair, and do not wet the head so often. Of all these reasons, Dr. Jackson regards the preservation of the fat and connective tissue of the scalp, and the greater care of the scalp, as the most important. The treatment of this variety of baldness is mainly one of prophylaxis and hygiene. In families where it is hereditary, this should begin at birth, and continue through life. The scalp should be kept clean by an occasional shampoo of soap and water, borax and water, or some such simple means. This should not be repeated oftener than once in two or three weeks; and after the washing, the scalp should be carefully dried, and vaseline or sweet-almond oil applied. Women should dry the hair by the fire or in the sun, and not dress it until dry. The hair should be thoroughly brushed and combed daily, for five or ten minutes, with vigor sufficient to make the scalp glow. For this a brush should have long and moderately stiff bristles, set in groups widely separated from each other. Such a brush will reach the scalp, and brush out the dust. A comb with large, smooth teeth should be used with the brush, to open up the hair to the air. Pomades should not be used, and the daily sousing of the hair discontinued. Women should not use bandoline, nor pull or twist the hair, nor scorch it with curling-irons, nor smother it under false hair. Easy-fitting, light, and ventilated hats should be worn, and working under hot artificial light should be avoided. Mr. Goninlock, writing on baldness in the *Popular science monthly*, gives it as his opinion that it is due principally to the high hat and the hard felt hat, and to any other covering that constricts the blood-vessels which nourish the hair-bulbs. Few, he says, will escape the evil effects of twenty or thirty years of rigid tight-fitting hats, the destructive process being delayed only by the length and frequency of respites from this tourniquet of fashion.

FIG 1. — INDIAN CHAIR, SHOWING THE SISIUTL AND THE RAVEN, THE CREST OF THE OWNER. (Length 7 feet.)

## *ETHNOLOGICAL NOTES.*

### *The serpent among the north-west American Indians.*

THE latest issue of the *American antiquarian* contains a long article on the serpent symbol, by the editor, the Rev. Stephen D. Peet. He traces the occurrence of the serpent symbol or serpent myths among many tribes of America. We shall add here several notes on a peculiar form of serpent which plays an important part in the traditions of the north-west American natives. A characteristic representation is fig. 2, a double-headed snake with a human face in the centre. It is known to the Selish tribes of the Gulf of Georgia, and to the numerous tribes of Kwakiutl lineage. According to Swan, a similar monstrous being, the Hahéktoak, is known to the Makah of Cape Flattery. It has the faculty of assuming any shape it desires, and appears most frequently in the form of a beautiful fish with sparkling scales. It moves with both heads turning for-

FIG 2. — DANCING-IMPLEMENT, REPRESENTING THE SISIUTL.

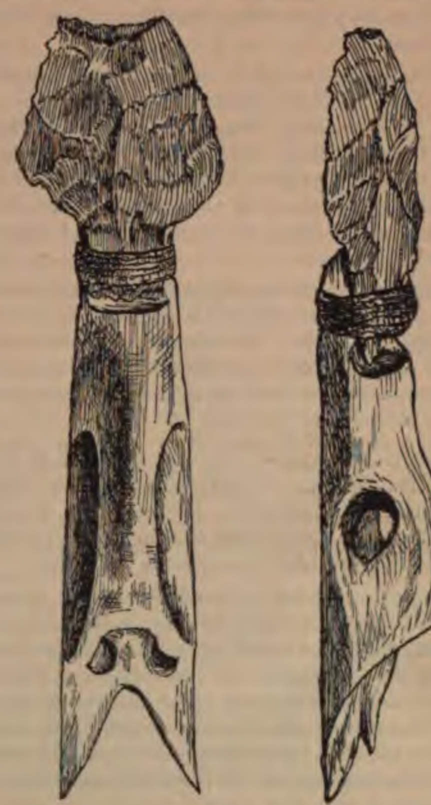
ward, the human face in the centre looking backward. It is the crest of one of the gentes of the Kwakiutl, who paint it on their house-fronts. The beam which supports the heavy rafters of their houses is carved so as to represent the 'Sisiutl,' as it is called by the Kwakiutl; and the drums, chairs, and dancing-implements of the gens have it for their ornament. A beam of this kind is in the museum at Ottawa, Ont. We have seen a mask of this style in the museum of Berlin. Two knives of the same description, which are used in certain dances, are shown in figs. 3 and 4. Fig. 2 is used in the dances of several tribes, the dancer having a blanket tied round his loins, the upper part of his body being naked. He wears a head-ring and neck-ring of hemlock branches, and has the carved image of the Sisiutl tied to his stomach. Fig. 1 is a remarkable chair, representing the Sisiutl. It will be seen from our figure that here the central figure is winged, and that two additional legs appear on both sides. This is because the owner's father belongs to the raven gens, while his mother belonged to the Sisiutl gens. Therefore both crests are embodied in the design, which is very characteristic. It is engraved from a sketch made on the spot.

FIGS. 3 and 4. — KNIFE AND DANCING-IMPLEMENT, REPRESENTING THE SISIUTL. (From Jacobsen's 'Nordwestküste Amerikas.')

The traditions referring to the Sisiutl are very numerous. One of the most remarkable is that Qaniqilaq, the son of God, descended from heaven and met the Sisiutl. He killed it, skinned it, and took out its eyes. The latter he used as stones for his sling, the former as a belt, and both served him to accomplish many exploits.

Other tribes of the same region tell of the same being, but they believe that it lives somewhere at the bottom of the sea. They tell of a man who killed it, and thus acquired supernatural qualities. Among the Qauitchin this tradition is of great importance. They say that the first man of their race encountered the serpent and killed it. Whoever obtains a bone of the serpent becomes a formidable sorcerer, as the sight of it kills whomsoever sees it. The same is told of the Hahéktoak of the Makah, but the latter has a different shape, being single-headed.

ESKIMO HARPOON. — The ethnological collection of Mr. A. Sturgis, on exhibition in the American museum of natural history in New York, contains a fine specimen of an Eskimo harpoon-head from Greenland, which we figure here by the kind permission of Mr. Sturgis. There are very few specimens of this kind in the ethnological collections of America and Europe, the flint head being nowadays replaced by iron. The present implement



ESKIMO HARPOON-HEAD. (From A. Sturgis's collection.)

is of special interest, as it shows the same form as those from the west coast of Davis Strait, and the way in which the Eskimo used to fasten the stone

head to the ivory part. It belongs to the large sealing and walrus harpoon. A similar specimen is in the collections of the British museum. Both these specimens show two perforations at the lower end of the harpoon-head which are not found in the modern ones. Probably these served for holding the harpoon-head to the shaft by means of a thin line, in order to prevent the head from coming off before the seal or walrus was struck.

## NOTES AND NEWS.

A GEOLOGICAL society has been founded at Brussels. The foundation of such a society was planned in 1872, after the meeting of the archeological and prehistorical congress; the efforts, however, were unsuccessful, though this became the impulse for the foundation of the geological society at Liege. Mr. A. Houzeau de Letaie took up the old plan, and on April 17, 1887, the foundation of the society, under the name 'Société Belge de géologie de paléontologie et d'hydrologie,' was announced.

— The fourth annual convention of the Association of official agricultural chemists will meet at the U. S. department of agriculture in Washington on Tuesday, Aug. 16, at ten o'clock. Tuesday and Wednesday will be devoted to a discussion of the method of analysis of commercial fertilizers; Thursday and Friday, to cattle-food and dairy-products.

— The advance of education in India is marked by the post-office statistics for the ten years ending March 31, 1886. The number of letters increased from 119,000,000 to 238,000,000 per annum, and the increase in the number of newspapers sent was no less than 115 per cent.

— Mr. Edwin Arnold has just presented to the Indian institute at Oxford, through the vice-chancellor of the university, the Buddhist manuscripts and Pali books given to him by the priests of Ceylon during his recent visit to that island.

— Bates college has received an offer of thirty thousand dollars provided an additional hundred thousand dollars be raised by subscription among the friends and alumni of the college. Of this hundred thousand dollars, it is understood that nearly one-half is already subscribed. It is proposed to spend at least twenty-five thousand dollars of the total amount in founding an observatory.

— Harvard university announces a considerable expansion of its courses in English for next year. Professor Child will offer courses in the English Bible and in Spenser. Professor Briggs will lecture on English literature from Shakspeare to Dryden, excluding Milton. Professor Hill will add to his usual course on the prose writers of the seventeenth and eighteenth centuries a course on the prose writers of the nineteenth century. Mr. Wendell will take a class through the study of the English drama, excluding Shakspeare.

— The Students' aid society of Boston has aided over four hundred worthy students since its organization. Most of the beneficiaries have become teachers. President Freeman of Wellesley recently told what had become of the twenty-five girls aided by the society who graduated from Wellesley in 1886. Three of them are teaching in foreign countries, two among the colored population in the south, and two among the Mormons. Six are at the head of girls' schools in various portions of the country.

— The American public health association will hold its fifteenth annual meeting at Memphis, Tenn., on Nov. 8 to 11, 1887. The topics which have been selected for discussion are, 1°, the pollution of water-supplies; 2°, the disposal of refuse matter of cities; 3°, the disposal of refuse matter of villages, summer resorts, and isolated tenements; 4°, animal diseases dangerous to man.

— Bacteriologists are studying with great thoroughness and persistence the characteristics of the typhoid bacillus. M. Chautemesse, in the course of his researches, has found that this microbe forms spores at a temperature between 19° and 48° C. It develops even in sterilized water. At a temperature of 45° C. the cultivations live for several days, but are destroyed by boiling. The bacilli are destroyed by a solution of bichloride of mercury of the strength of 1 to 20,000, and by a solution of sulphate of quinine, 1 to 800. Carbolic acid, 1 to 400, has no effect upon them, and they are not affected by hydrochloric acid. This latter observation would seem to indicate that the germ would retain its vitality in the gastric juice.

— We learn from the London *Electrical review* (April 22) that Prof. E. Frankland, the well-known professor of chemistry, has recently patented some improvements which he has devised in storage-batteries, the object aimed at being the avoidance of both buckling and the gradual detachment of the active composition from the metallic portion of the plates, both these effects being brought about by the expansion of the active material during the use of the battery. This is effected, firstly, by so enclosing or embedding the active composition in the metallic portion of the plate as to prevent its falling out; and, secondly, by giving sufficient strength to the plate to enable it to resist bending or buckling. Professor Frankland em-

ploys as the active material the hardening mixture of oxide of lead and sulphuric acid, for which letters patent were granted to him in the year 1882 (No. 4,303); and whilst this mixture is in a pasty condition he moulds it into small cylinders or rods of convenient length and thickness, either by rolling, pressure through a draw-plate or tube, or other convenient means, and then flattens them on two opposite sides by pressure between two flat boards or otherwise. After these flattened cylinders have become sufficiently hard, they are placed in rows in a casting mould of dimensions corresponding to the size of the battery-plate required, and at such distances apart and from the edges of the mould as to give sufficient space for the quantity of metal necessary to impart adequate strength and rigidity to the plate. Suitable molten metal, such as lead or an alloy of lead and antimony, is then poured into the mould until the interstices between the flattened cylinders are completely filled. In this way a plate is obtained, in which the active material is incased except on the flattened sides of the cylinders overlaid with metal, so that it cannot subsequently fall out during the charging and discharging of the battery, or even when subjected to considerable rough usage.

— At a recent meeting of the Physical society, London, Mr. C. V. Boys described some methods of producing very fine glass fibres. The author finds it best to use very small quantities at high temperatures, and that the velocity of separation should be as great as possible. To obtain a great velocity, Mr. Boys used a cross-bow and straw arrow, to the tail of which a thin rod of the substance to be drawn is cemented. The free end of the rod is held between the fingers, and, when the middle part has been heated to the required temperature, the string of the cross-bow is suddenly released, thus projecting the arrow with great velocity, and drawing out a long fine fibre. By this means fibres of glass less than one ten-thousandth of an inch in diameter can be made. The author has also experimented on many minerals, such as quartz, sapphire, ruby, garnet, felspar, fluor-spar, augite, emerald, etc., with more or less success. Ruby, sapphire, and fluor-spar cannot well be drawn into fibres by this process, but quartz, augite, and felspar give very satisfactory results. Garnet, when treated at low temperatures, yields fibres exhibiting the most beautiful colors. Some very interesting results have been obtained with quartz, from which fibres less than one hundred-thousandth of an inch in diameter have been obtained. It cannot be drawn directly from the crystal, but has to be slowly heated, fused, and cast in a thin rod, which rod is attached to the arrow as previously described. Quartz fibre exhibits remarkable properties, as it seems to be free from torsional fatigue, so evident in glass and metallic fibres, and on this account is most valuable for instruments requiring torsional control. The tenacity of such fibres is about fifty tons on the square inch.

— The London *Times* publishes a telegram from Vienna to the effect that a Greek scholar, M. Papageorgiu, residing in Philippopolis, has discovered an ancient manuscript containing portions of Aristotle's works. The manuscript is of the fourteenth century, and contains one hundred and eighty pages, which comprises four books of the treatise 'On the heavens,' two books of 'On generation and decay,' the first three books of 'On the soul,' and parts of the 'Sophistical refutations.' The manuscript is in an excellent state of preservation, the vellum being clean and strong, and all the writing perfectly legible. There are marginal annotations of the fifteenth century. M. Papageorgiu, on completing his researches, will publish an account of them in pamphlet form. The chief point brought out thus far by him is that the newly found manuscript differs in some important particulars from Didot's and other existing editions. Moreover, it contains extracts only from the genuine Aristotelian writings, and nothing from the writings which are usually held to be spurious.

— J. Liznar (*Wiener akad. Anzeiger*, 1887) has arranged and computed the observations on terrestrial magnetism of the international polar stations of Fort Rae and Jan Mayen, in order to inquire into the existence of a period of twenty-six days of the magnetical phenomena. As the periodical oscillations of the magnetical elements are the greater the closer we approach the magnetical pole, the observations of Fort Rae, Cumberland Sound, and Jan Mayen were the most favorable for these researches. As those of Cumberland Sound were not published until the close of last year, Liznar confined himself to arranging the available material from Fort Rae and Jan Mayen. The result of his inquiries is, that the amplitude of the period of the oscillations of declination is 55.1′ at Fort Rae, 34.8′ at Jan Mayen, while it is only 0.4′ at Vienna, and 1.4′ at Pawlowsk. The length of the period is 25.85 days, while former computations gave a value of 25.97 days. These results show that the rotation of the sun, which is the probable cause of these periods, has a far greater influence on the magnetical elements, as might have been anticipated from observations in lower latitudes.

— In *Scribner's magazine* for July, Prof. D. A. Sargent, M.D., of Harvard college, who is an au-

thority on the general subject of athletics, will publish his first extended article in that field, under the title 'The physical proportions of the typical man.' In it Professor Sargent will give a standard of physical measurement, based on the measurements of ten thousand individuals. This furnishes a basis of comparison by which any person can gauge his proportions with those of the typical man. The article will contain charts for this purpose, founded on these observations.

— Messrs. G. P. Putnam's Sons, New York, have published a seventh edition of 'Voice, song, and speech,' by Lenox Browne and Emil Behnke. Six editions of this work have been exhausted since its publication three years ago. The last two editions have been published in cheaper form, in compliance with what was believed to be a public demand. In order to attain this end, the most expensive item of the earlier editions has been omitted; namely, the photographs of the larynx and soft palate during the tone-production, engravings being substituted. In all other respects the book remains unaltered.

— The final excursion (to the region of the Upper Delaware, the Shawangunk Mountains, and the Catskills) arranged in connection with the spring course of lectures on geology, of the Philadelphia academy of sciences, will extend over a period of two weeks, beginning with the first week in July. The field-study will comprise an examination of the Devonian rocks, with their contained fossils, and the general phenomena of glaciation, erosion, and mountain and valley formation.

— Several papers on 'French traits,' by W. C. Brownell, the first of which, on 'The social instinct,' will appear in *Scribner's magazine* for July, are the fruit of discriminating observation by one who has a keen appreciation of, and sympathy with, the French mind. In these essays it is said that Mr. Brownell will make many striking comparisons between English and American, and French social life and customs.

— The well-known catalogue of scientific books issued by D. Van Nostrand, New York, has been entirely revised to date. All the new and more important works in the different branches of science have been added, and considerable reductions in prices have been made.

— The latest biography in the American statesmen series is 'Henry Clay,' by Carl Schurz (Boston, Houghton, Mifflin & Co.). Mr. Schurz takes two volumes to tell the story of the great leader's life, and he does it with marked vivacity of style, and accuracy of detail. The design of the entire series is being as faithfully carried out as it was well conceived.

— Professor Arthur T. Hadley of Yale has been made lecturer on railroad administration at Harvard. This is a well-deserved compliment to Professor Hadley's abilities.

— The list of royal authors is to be increased by the addition of the name of King Leopold of the Belgians, who is preparing a somewhat elaborate history of the conquest of England by the Normans. The king recently visited the battle-field of Hastings in order to locate the spot where Harold fell.

— The general council of the University of Glasgow has decided that the establishment of a chair of education in the university is necessary.

— Eaton now has 964 names on its roll, the largest number on record. At Harrow 541 are registered.

— At the University of London recently, twenty-five ladies were presented for the A.B. degree, ten of them with honor, and two for the B.Sc. degree.

— Professor Prestwich has resigned the chair of geology at Oxford, feeling himself unable to carry on the great amount of work required.

— The Russian government is about to have a series of pipe-lines laid down for the conveyance of petroleum over the Suram Pass, a distance of thirty-five miles. At present the oil is transported over the pass in short trains of six tank-cars each, with two engines to each train. Upon the completion of the pipe-lines, the oil will be pumped from reservoirs at Michalova, on the Tiflis side of the Pass, directly into similar reservoirs at Kirrill, on the Batum side.

— A company in London, England, furnishes water, at a pressure of 700 pounds to the square inch, to customers, for running elevators, printing-presses, pumps, etc., through the medium of water-motors. The company has twenty miles of main laid, and furnishes water for 458 motors.

— The sixtieth annual meeting of the German natural scientists and physicians will be held at Wiesbaden from Sept. 18 to Sept. 24 next. In connection with the meeting, an exhibition has been arranged for, to include new and complete sets of apparatus, instruments, and so forth.

— With its issue for May 5 last, the *Central-Organ für die Interessen des Realschulwesens* published a most valuable list of all the works on Scandinavia and its literature that appeared during the year 1886.

— The King of Italy has signed a decree authorizing the publication of a new and complete edition of Galileo's works, at the expense of the state. The ministry of education has, with the co-operation of leading scientists, undertaken the preparation of this edition. It will comprise twenty quarto volumes, of about five hundred pages each.

— Work on the tunnel under the Hudson, between Jersey City and New York, has recommenced, and an average progress of three feet per day is being made. Incandescent electric lights are being substituted for the arc lights previously employed.

— There are at present upwards of one hundred miles of cable-railway in operation in this country, and about fifty miles in course of construction.

— The Clarendon press, Oxford, propose to publish from time to time, under the title 'Annals of botany,' original papers, adequately illustrated, on subjects pertaining to all branches of botanical science; also articles on the history of botany, reviews and criticisms of botanical works, reports of progress in the different departments of the science, short notes and letters. A record of botanical works published in the English language will be a special feature.

— The French are preparing a series of monographs identical in scope and character with the very successful 'English men of letters' series. The title will be 'Les grands écrivains français,' and the following volumes are already announced: 'Victor Cousin,' by M. Jules Simon; 'Madame de Sévigné,' by M. Gaston Boissier; 'George Sand,' by M. Caro; 'Turgot,' by M. Léon Say; 'Montesquieu,' by M. Sorel; 'Voltaire,' by M. Brunetière; 'Villon,' by M. Gaston Paris; 'D'Aubigné,' by M. Guillaume Guizot; 'Racine,' by M. Anatole France; 'Boileau,' by M. Brunetière; 'Pascal,' by M. Havet; 'Rousseau,' by M. Cherbuliez; 'Joseph de Maistre,' by the Vicomte E. Melchior de Vogüé; 'Lamartine,' by M. de Pomairols; 'Balzac,' by M. Paul Bourget; 'Musset,' by M. Jules Lemaître; 'Sainte-Beuve,' by M. Taine; and 'Guizot,' by M. G. Monod.

— Sir Henry Roscoe, M.P., has introduced a bill into parliament to make provision in day-schools by which young persons who have passed through the public elementary schools, and others, may obtain further instruction in technical subjects. The bill empowers any school board, local authority, or managers of a public elementary school, to provide day technical and commercial schools and classes for the purpose of giving instruction in any of certain subjects. These include the several science subjects which are specified in the directory of the science and art department, and in which that department undertakes to examine. The following subjects are also included: the use of ordinary tools, commercial arithmetic, commercial geography, book-keeping, French, German, and other foreign languages, and freehand and machine drawing. The addition of other subjects may be sanctioned from time to time by the committee of council on education or by the science and art department. For the purpose of carrying on these schools and classes, the power of school boards, other local authorities, and school managers, is to be in every respect the same as for providing ordinary elementary schools. Moreover, they are to have power to provide, or contribute to the maintenance of, laboratories and workshops in endowed schools for the purpose of carrying on classes or instruction under the bill. However, all these schools and classes are to be subject to the inspection of the officers of the committee of education or of the science and art department; and before a scholar is admitted he must have passed the sixth standard or some equivalent examination. The education committee and the science and art department are authorized to give grants on such conditions as they may lay down for any of the subjects taught in these technical or commercial schools or classes. For the purpose of obtaining grants, a technical school or class must be one carried on under minutes to be made by the science and art department, and laid on the table of the house of commons in the same way as the minutes that regulate the grants of the education department.

— Beginning with September, 1887, the University of Kansas will offer, in addition to the general and special courses already in existence, a four-years' course in electrical engineering.

— The date of inauguration of the mineral exhibition at Lima, Peru, has been changed from Oct. 1, 1887, to June 21, 1888.

## LETTERS TO THE EDITOR.

**** *The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### Height of a meteor.

MY observation of the course of the meteor which appeared at about 8.42 on the evening of June 15

may perhaps be made use of in determining the height of the meteor above the earth's surface.

When I first saw the meteor, it was passing, I should say, through the constellation Leo Minor. I am confident that it passed a little east of Beta Leonis Majoris, say three degrees, and I think that it passed east of Gamma Virginis, near which it disappeared. While passing between these two stars, it emitted two flashes of brighter light, — white or somewhat bluish. Its motion was slow.

J. R. W.

Dorchester, Mass., June 21.

## Museums of ethnology and their classification.

The article of Dr. Boas, to which you call attention in your note to myself, treats of two distinct subjects: first, the interpretation of similarities; and, second, the best method of grouping archeological objects in the museum. In Professor Mason's report the same subjects are discussed. The interpretation question has but a very remote connection with the museum question, and as I have already discussed it somewhat at length in the 'Third annual report of the bureau of ethnology,' under the head of 'Activital similarities,' I think I may well neglect that subject in this short communication.

The functions of a museum are twofold: first, as a repository of materials for the investigator; second, as an objective exemplification of some system of knowledge pertaining to the subject for which the collection is made, to be used by an instructor with his pupils, and as an exhibition of facts for the passing observer who visits the museum.

The first purpose is of prime importance: the history of museum administration abundantly develops this fact, and more and more is its value understood. It is in this manner that great museums make substantial contributions to science, and increase the knowledge of the world. The successful management of a museum for this purpose involves the study of museum cases and various other appliances and devices, together with museum records, descriptive catalogues, etc. In the performance of this function the methods and appliances of the national museum are of the highest excellence, but it would require a volume to fully set them forth. Professor Baird, one of the greatest organizing minds of the scientific world, has devoted a large part of his life to this subject.

The secondary use of a museum, mentioned above, somewhat interferes with its primary use; and because it is secondary it must not be allowed to interfere with the more important function. In a great museum like that at the national capital, the collections are so vast that the public exhibition of them all is impossible: only a very small per cent can be shown with reasonable expenditure. This being the case, the secondary use interferes with the primary use only to that limited extent. A few selections are made to be shown to the public: the great mass of material is kept ready to do service for the investigator. Therefore, with regard to the arrangement of the materials for the museum for public exhibition, the question is narrowed down to this: first, on what principles shall the selections be made? and, second, in what order shall they be arranged? That is, the administrator of the museum is called upon to determine what is the most useful lesson to the general public which his materials can be made to teach. Every investigator will be more or less likely to consider his own subject of prime importance, as it is to himself; and every instructor is, in like manner, likely to consider that his system of instruction is of prime importance. As research progresses, one set of problems after another comes to the front, and is for the time being of chief importance. For such reasons the museum appliances for exhibition should be of an easily adjustable kind. No sound philosophic scholar, be he investigator or instructor, will assert that his own system is complete and final, that any classification or arrangement is ultimate. It is in view of these facts that the authorities of the national museum have devoted their efforts very largely to methods of exhibition, to the consideration of cases, trays, stands for mounting, etc., so as to have the parts interchangeable and easily readjusted to new conditions, — new facts arising from the advance of the science and from the enrichment of the collections; and it seems to me that many problems involved have been very satisfactorily solved. The actual exhibition portion of the collection in the national museum has not been put into permanent shape. What has been done has been experimental and tentative. The arrangement at one time may be very different from that of another; and this is rendered easy and inexpensive by reason of the system above described.

Now, Dr. Boas offers a system or plan for the arrangement of the materials which relate to the pre-Columbian peoples of America and their descendants. He would have them arranged by tribes. On the discovery of America there were probably many more than twenty-five thousand tribes inhabiting the country, each a little band of people organized into a body-politic, and autonomous, at least for all domestic purposes. But probably within the first year, changes were made in some of these bodies-politic: some coalesced by treaty or conquest, others divided through disagreement, individuals from some tribes took up their abode and became incorporated with other tribes: and so, by various methods from time to time, all of these bodies-politic were in a flux; so that a hundred years after the discovery of America it is not probable that there existed any one tribe which could claim to be the pure and simple descendant, without loss, admixture, or change, of any tribe existing at the time of the discovery. These changes have been going on more and more rapidly until the present time, and they are still going on. Most of the tribes best known to history have been absorbed, consolidated, and redivided again and again. Now, this means simply that under primitive and under modern conditions alike there has been no permanent tribal organization, — a body-politic whose history can be followed as that of one people by hereditary descent. A museum collected to represent the tribes of America, therefore, to be properly representative, would have to be collected as the census of the native inhabitants of India has been taken, all in one day, by an army of collectors. Collected in any other way, it would have no proper significance; and collected in the manner suggested, it would have very little scientific value.

But if a classification of the tribes of North America were possible, the archeologic collections actually made in the country could not be relegated to them, for the tribes have been forever migrant.

The materials are derived from a variety of sources, which may be briefly enumerated as follows. First, those taken from the mounds. But we now know that many tribes have erected mounds, and ofttimes the same mounds have been occupied by different tribes belonging even to different linguistic stocks. Only a few mounds have been or can be relegated to the Indians who built them. Second, another class of materials has been found in stone graves, ossuaries, and other burial-places; but it is rarely the case that these burial-places can be referred to the specific tribes that used them. Third, much of the material is distributed on the surface of the earth, and picked up in woods, fields, caves, etc.; but it is very rarely indeed that any of this material can be referred to specific tribes. Then there is a vast body of material in the ruins of the arid regions of the west, very little of which can be relegated to specific tribes. Again, collections have been made from time to time, in the years and centuries past, from the Indians themselves; but as these tribes have been ever changing, as heretofore remarked, and as the names of tribes change from time to time, so that the synonymy is exceedingly complex and difficult, the same names being used for different tribes, and the same tribe being known by different names, there is no historical collection of any magnitude in the land that could with confidence be affirmed as coming from definite, specified tribes. Again, very many of the articles which are brought together in a large archeologic museum are the materials of barter from tribe to tribe. This barter has been on a scale so extensive, that, if there were no other difficulties in the way of determining the inventors and makers, this would be sufficient to cast a doubt upon nearly all collections made. There is yet another source that contaminates much of the material collected, and puzzles the student of archeology to the highest degree. Stone implements, shell ornaments, copper implements, utensils, etc., were, in the early history of the country, manufactured on a large scale by traders, to be bartered with the Indians for peltries. A vast amount of this material was thus manufactured; and, because it was more or less superior to the work of the Indians themselves, it intrudes its way before all other objects into the collections of the country.

It will be seen, that, taking all things together, a tribal arrangement of the archeologic museum of North America is an impossibility by reason of its nature.

But the tribal museum as suggested by Dr. Boas would, in practical affairs, be an impossibility by reason of its magnitude. In the many thousand groups of which it would be composed, the objective material would be duplicated over and over again, and to the observer would be monotonous and meaningless.

But may not the tribes be classified? The so-called 'ethnic' classifications of mankind have usually been based upon physical characteristics, found in the relative proportions of the parts of the body, which has led to a high development of anthropometry; in the characteristics of the cranium, which has led to a high development of craniology; and in the color of the skin, the texture of the hair, the attitude of the eyes, etc.; but no thorough classification of mankind on these characteristics has ever been established. This only has been done: a greater or less number of varieties have been described as types; but, whenever the attempt has been made to relegate the peoples of the world to these varietal types, the task has been found impossible. Mankind cannot be classified into races thoroughly inclusive and exclusive. Very much more has been done in the classification of languages; but this furnishes a very imperfect classification of peoples. In fact, it does not properly mean an ethnic classification. I know of no attempt to classify mankind by arts, or by institutions, or by opinions, worthy of the mention; yet arts may be classified, institutions may be classified, and opinions or philosophies may be classified, but the results thereof are in no proper sense a classification of peoples.

In this connection it is sufficient to say, that, as there is and can be no ethnic classification of the tribes of America, so there can be no classification of their arts on that basis. Yet we might classify their arts in a museum on the basis of classes derived from linguistic affinities; but it would be wholly arbitrary, and lead to no valuable results. The Pai-utes of Utah, the Comanches of the plains, and six of the Pueblos of New Mexico, that are called by the bureau of ethnology the 'Shinumos,' and included in the ancient province of Tusayan, all belong to the same linguistic family; but their arts are most diverse, as will readily occur to any one familiar with the subject. The Apaches of Arizona and New Mexico would be thrown into a group with the Tinne Indians in the region of Lake Athabasca. And like illustrations might be extended to an indefinite length.

Dr. Boas suggests a geographic distribution in a manner which makes it appear that he considers a geographic classification to be essentially the same as an ethnographic classification, but the two are altogether different things. It is said that prairie-dogs, owls, and rattlesnakes successively occupy certain underground habitations on the plains, but they are not thereby classed as one group in systematic zoölogy; and he who supposes that the multifarious tribes in one region of America are of the same stock, or can in any proper way be classified as one, has failed to understand the ethnology of the American races. But this leads to the consideration of a classification by geographic provinces, as advocated by Bastian and referred to by Boas. If the primary classification of the museum should have this basis, some very interesting facts would be presented. It is well known that zoölogic provinces and botanical provinces have been defined by various biologists, and the facts connected therewith are of great interest. In like manner the art provinces of North America are of great interest. To this subject the bureau of ethnology, under my charge, has given much attention, and gradually we are reaching some interesting results; and at the present stage of this research, if we could have a grand museum arranged on this basis, investigations would be made with greater ease, and perhaps facts and ideas would be suggested which will not be discovered in the lack of such a grand museum. Yet I should hesitate to affirm that that was the best arrangement for the national museum or any other great collection.

The human activities which characterize mankind may be classed as arts, institutions, languages, and opinions or philosophies. Of these activities, the arts only can be represented in a museum, and they but in part. An anthropological museum, therefore,

is an impossibility; but we may have a museum of arts, including the arts industrial and aesthetic. But, while such a museum might be possible, it is impracticable, for a collection of the arts of all peoples of all times would be of such magnitude that it could not properly be made and preserved within practical conditions of economy. That which the great institutions of the world really attempt is an archeological museum, — a museum of the antiquities of the higher races, and of the past and present of the lower races. In the administration of such a museum it may be considered best to segregate a part thereof for exhibition, as indicated in a previous part of this letter; but their arrangement by tribes on ethnic characteristics of any kind is an impossibility. Their arrangement by geographic districts is possible, but the lessons taught thereby are not of prime importance, and the cost of such an exhibition would be excessively expensive, — quite out of proportion to the value of the results. The scientific or technologic classification is all that remains, and this has yet to be developed.

Will the editor of *Science* indulge me in one more remark, as a corollary to what I have said?

There is a science of anthropology, composed of subsidiary sciences, which I group as follows: the biology of man, which is the study of the animal man, and may be considered as belonging to biology proper, or anthropology; there is a science of psychology, which is a part of anthropology; there is a science of technology, which includes all the arts of mankind; there is a science of sociology, which includes all the institutions of mankind; there is a science of philology, which includes the languages of mankind; and there is a science of philosophy, which includes the opinions of mankind; but there is no science of ethnology, for the attempt to classify mankind in groups has failed on every hand. Perhaps the most distinctive group of men yet discovered in the world are the Eskimos. They have in a general way physical characteristics which separate them from other peoples, but these distinctions fade out on the western coast of America and eastern coast of Asia. They have arts peculiar to an arctic habitat, but their arts are not exclusively their own. Their institutions are yet practically unknown. Their opinions, as represented in their mythologies, are imperfectly known, but they yet furnish no characteristics by which they can be segregated from many other peoples; and Mr. Dall has shown that their languages are not wholly unconnected with other languages of the north. But when the attempt is made to set up other races in the world, it wholly fails. The unity of mankind is the greatest induction of anthropology.

J. W. POWELL.

Washington, June 11.

I have to say a few words in reply to Major Powell's criticism of my letter in *Science* of May 20. It will be seen that in regard to several points which are discussed in my letter of June 17, and Major Powell's letter of to-day, there is no difference of opinion between Major Powell and myself, as his remarks would imply.

Major Powell infers that my remarks refer to archeological collections of pre-Columbian peoples. If he will kindly look at the contents of my two letters, he will see that no mention has been made of such collections, but that we discussed the general question of studying and arranging ethnological material. The mere fact that we do not know to which tribes archeological specimens belong excludes them from our discussion, and demands a different kind of treatment. I fully agree with Major Powell's remarks on this subject, but venture to say that they do not belong to the question at issue.

A few words more on Major Powell's remarks on the classification of tribes and the alleged impossibility of arranging a tribal museum. The problem has been solved by numerous museums, even much larger than the national museum. The ideal plan of their arrangement is to exhibit a full set of a representative of an ethnical group, and to show slight peculiarities in small special sets. Experience shows that this can be done with collections from all parts of the world without over-burdening the collection with duplicates, and without making artificial classifications — only by grouping the tribes according to ethnic similarities. Such groups are not at all intended to be classifications, as Major Powell infers in his remarks on this subject. The principal difference between the plan advocated by Major Powell and adopted by Professor Mason, and that of other museums, is, that the latter exhibit the individual phenomenon, while the former make classifications that are not founded on the phenomenon, but in the mind of the student.

DR. FRANZ BOAS.

New York, June 18.

## Small-pox hospitals.

In your issue of the 20th of May I notice a statement concerning the peculiar effect of small-pox in the vicinity of hospitals for that disease. Some years ago, small-pox was local here, and upon the termination of the case the bedding was burned in the yard of the premises; and I am informed, that, in the direction in which the smoke was driven by the wind, several cases of small-pox developed, while the surrounding neighborhood was otherwise free from it.

Among our acclimated people this disease is more dreaded than yellow-fever. The people here are opposed to burning bedding of yellow-fever patients, but favor burying or sinking in the channel. Our atmosphere never being purified by frost, our reliance must be upon the winds to purify and disinfect. Here every thing rapidly decays, and passes away into the atmosphere.

HORATIO CRAIN.

Key West, June 7.

## The scientific swindler again.

About six weeks ago a delightfully intelligent and amiable deaf-and-dumb man appeared in Pottsville, and was entertained hospitably by Mr. Bard Wells, late of the geological survey of Pennsylvania, to whom he gave some valuable books, and from whom he took some, also a compass. He left Pottsville suddenly without paying his hotel-bill.

About two weeks afterward he called at the office of the survey, in Philadelphia, after office-hours, and represented himself to the janitress as an assistant on the survey, sent by the assistant in charge of the office to get certain survey reports. Having no written order to show, he was refused admittance, and went away very angry.

I see that he has turned up at Syracuse. It is astonishing that the fellow can have managed to escape capture so long.

J. P. LESLEY.

### A Bayanzi execution.

It may be interesting to ethnologists to give a brief account of the mode of execution among the Bayanzi, a large tribe of negroes inhabiting the country between the Kongo and the river draining Lake Leopold II., which empties into the Kwa, the largest southern affluent of the Kongo. The Bayanzi are said to be peaceful negroes, quite skilful in agriculture, and to excel in wood-carving and working iron into weapons of various kinds.

The executioner's sword is a short, heavy two-edged weapon, blunt at the end, where it projects in

BAYANZI SWORD.

a spur on each side. The hilt is of wood wound with brass wire, giving a very firm grip. The series of shallow grooves through the middle are called 'blood-grooves.'

In executing, the condemned is made to sit down on a block just behind a post, his limbs passing on each side of it. The post reaches to the height of his chin. His arms, legs, and body are tied to stakes. A strong sapling is bent down, having at its extremity a collar suspended by cords. This collar is placed around the victim's neck, producing so great tension, that, when the executioner delivers the blow, the severed head is thrown into the air with the force of a bomb. In all probability, this device for making the neck taut arises from the clumsy nature of the sword employed, and the consequent difficulty in using it for decapitation. The post in front of the man's neck also facilitates the entire removal of the head. Previous to the execution it is usual for the people — men, women, and children — to torment the prisoner with fire-brands, thorns, and all sorts of devices, while he is in this uncomfortable pillory. This execution shows an ingenious arrangement of machinery to accomplish an end, resulting in a queer combination of hanging and decapitation.

The circumstance which forms the subject of this paper was witnessed in November, 1884, at Loukolela, by Mr. E. J. Glare. Lieut. E. H. Taunt, U. S. navy, collected the sword. Mr. W. P. Tisdel sent in a scythe-shaped sword said to have been used for the same purpose. So far as known by the writer, this is the first time that an account of the Bayanzi or a similar execution has ever been published.

WALTER HOUGH.

Washington, June 9.

### An advance in educational advertising.

The announcements annually made by the better class of educational institutions in this country are generally characterized by a wholesome modesty, both as to style and substance. Indeed, one might infer from their perusal that there existed among the educational fraternity a code of ethics nearly as rigorous as that of the medical profession. That many exceptions to this rule have occurred, and are occurring, has long been known; and ten years ago Prof. F. W. Clarke amused and interested the reading public by the publications of some choice selections from advertising literature issued by a few schools in the west and south, where, as Professor Clarke remarked, the people are 'untrammelled by effete conventionalities.' He also explained the backward state of the art in some other parts of the country by saying that "New England and the middle states are too much tied down by routine and tradition to produce such rare developments of the intellect."

It is gratifying to know that in one spot, at least, of this benighted region, it begins to look as if somebody had cut the string. The institution inaugurating a new departure is not found, as in the instances cited by Professor Clarke, in an obscure country town whose location is only revealed after a careful study of the map, but it is in and a part of the very 'Hub' itself. With the keen insight and business tact which is supposed to be inseparable from the genuine down-east Yankee, the author of the new idea has evidently studied the question of advertising with a determination to adopt that style which experience has shown to be the most successful. As might have been anticipated, the result of his investigations is apparently, that, in the present state of our knowledge of the art, its highest development is embodied in the methods of the vender of patent medicines.

Your New-Englander is nothing, however, if not cautious, and it must not be assumed that the full power of the new method has been brought into play at once. The first output was observed in the advertising columns of a well-known newspaper, a copy of which recently fell into the hands of the writer. The announcement of a widely known educational institution, everywhere recognized as one of the first, if not the very first, of its type, began with a display in large capitals of the words, '*Beware of imitators!*'

Had this phrase occurred in connection with the advertisement of some western school, 'untram-

melled by effete conventionalities,' it might have been clipped out and consigned to the collection so unselfishly organized and begun by Professor Clarke, but a second thought would hardly have been given to it. Emanating as it did, however, from the very heart of the Back Bay region, it is worthy of the serious and earnest consideration of all who are interested in educational progress.

What does it really mean? But two explanations seem plausible. The first, which is mentioned only to be rejected, is that the authorities of the institution under consideration are privately and unofficially of the opinion that it is a mistake; that its courses of study are ill-adjusted, its facilities and equipment meagre and inadequate; and, in short, that its patrons are being 'taken in.' Public or private admission of this belief would be fatal, but the demands of Puritan conscience cannot be wholly ignored; and the outcome is the ingeniously worded notice, which, while inviting confidence in the school itself, generously warns the public against any and all others who may be trying to do the same thing in the same way. Such an intricate and delicate system of ethics might possibly originate in the vicinage of the Concord school, but to ordinary people it is incomprehensible, and the hypothesis is rejected as being untenable.

There remains only the explanation which has already been suggested: it is the beginning of new things in college advertising, or, rather, it is the application of the old and well-established, none-genuine-unless-the-name-is-blown-in-the-bottle method in a new direction. That the advantages of the new departure will be universally recognized cannot be questioned. Indeed, it can be shown that a little timid experimentation along the new line had already been undertaken by institutions more or less 'untrammelled;' but, now that cultured Boston has stamped the guinea, it can no longer be looked upon with suspicion.

Our friends of the west and south may now begin to woo the public in this new but entirely orthodox manner, and ample opportunity will be afforded for the display of hitherto unsuspected genius. Even the most venerable and conservative schools must expect to be drawn in, or they will be distanced in the race. The infinite variety of which the new method is capable is shown on every page of the daily paper; but it is more than likely that some special line will be worked, and among various styles something like the following is likely to be popular: —

A CURIOUS CIRCUMSTANCE!

There has been much comment and discussion on the street to-day, in reference to the fortunate escape of Mr. Beverly Witherspoon from drowning, when the tug-boat Martha went down yesterday. Just as the unfortunate boat was entering the harbor, she was struck amidships by a huge wave, which capsized her, and all on board were lost. Had Mr. Witherspoon been on board of the Martha, he would have gone down with the rest. When questioned by a reporter to-day, he declared that he could only attribute his good fortune to the fact that he was educated at the ——— ———, an institution of learning which is widely, etc.

Or this: —

ADMIRAL ——— ———,
President of the ——— ———.

*Dear Sir*, — Although generally unwilling to appear as in any way favoring institutions of learning, I cannot refuse to allow you to publish the true history of my son's case, if the interests of humanity will be furthered thereby. For several years my son was afflicted with ignorance and stupidity. As he grew older the affliction increased, and at last I felt compelled to send him to school in the hope of effecting a cure. During several years, and at vast expense, I kept this up, sending him to the famous H———d university, the college of N—— J—— at P———, Y—— college, and other well-known schools; but he grew worse all of the time, and appeared to be rapidly approaching imbecility. One day, just as I was about to give up in despair, a friend accidentally mentioned your institution, and spoke of the great benefit it had been to a young man of his acquaintance who was similarly afflicted. Like the proverbial drowning man, I was ready to catch at a straw, so I at once put my son under your care. At the end of three months a great improvement was observed; after a year, intervals of lucidity became more frequent; and at the end of his course, when he had received your diploma, he was able to procure an excellent position as a writer of articles on political economy. I have no objection to your mentioning my name in your future advertisements.

Yours respectfully,
——— ———.

But, unless the thing is copyrighted, its originators will be obliged to keep a sharp lookout, as a great deal of this sort of talent is lying around loose.

X.

## Queries.

6. VOLAPÜK. — Where can I obtain any specific information concerning Volapük, the universal language about which a note appeared recently in *Science*? — H. T. P.

[Volapük was invented by Father Johann Martin Schleyer of Constance, Baden, Germany, and an inquiry addressed to him would undoubtedly elicit information as to literature, etc. M. M. Hachette et Cie, the well-known Paris publishers, have recently issued a book on this subject. — ED.]

# SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 24, 1887.


## *INDIAN CRADLES AND HEAD-FLATTENING.*

I AM indebted to Dr. R. W. Shufeldt and Dr. Washington Matthews, both of the U. S. army, for the suggestion that a more intimate study of Indian cradles is demanded by those who are investigating the subject of cranial deformation.

In studying this subject, it is well to bear in mind the fact that among the Eskimos and Indians of the far north, as well as among the Indians of the tropics, cradle boards or frames are impracticable. In the former region the cold is too intense; in the latter, clothing of any kind is unnecessary. The student must remember, also, that the use of cradles extends over the first year of a child's life, beginning when it is absolutely helpless, and ending with the time when the child can stand alone in its cradle, and finally walk out of it. In all these cases, functionally if not structurally, the cradle is modified in harmony with its occupant. It must be remembered, also, that culture-gradus, natural supplies, and the appliances and decorations of each tribe, have an effect on the cradle. Properly speaking, cradles are divided structurally into quasi genera and species: they are intimately related to their environment, they have their ontogeny and phylogeny, and they are formed and fashioned in co-ordination with the whole industrial life of their respective tribes.

The parts of a cradle are, 1°, the frame; 2°, the bed; 3°, the pillow; 4°, the wrappings and lashings; 5°, the carrying appliances; 6°, the decoration.

The young Eskimo, when it goes abroad, finds its carriage in its mother's hood. This custom is universal from Labrador to Mount St. Elias, and the maternal *parka* is made capacious accordingly.

The Tinné stock of the Yukon River make their tray-shaped cradle of birch-bark, with hood and awning of the same material. No attempt is made at a permanent bed or pillow. The child in its wrappings is laid in the cradle, and lashed securely.

The national museum does not possess an Indian cradle from the Haida or Tlingit Indians. The Bella Bella Indians of British Columbia make a little ark of cedar-wood, with head-board sloping upward. The bed is an abundance of finely shredded cedar-bark. The child is laid in this soft couch, wrapped with flaps of buckskin, and lashed in with a leather string. Totemic devices are painted on the head-board.

Coming southward, we encounter the Chinook cradle, a trough of cedar-wood, carved to imitate a scow-boat. The bed is soft bast or cedar-bark. The remarkable feature is the pad drawn down upon the forehead Compare this with the awning of the Yukon cradle. Query: Did many Indian cradles formerly have a device to keep the heads of very small children from falling down while the cradle was in a vertical position, and did most tribes abandon it because it affected the shape of the child's head, while the Chinook retained it for the same reason? In scientific phrase, is this a case of survival or atavism?

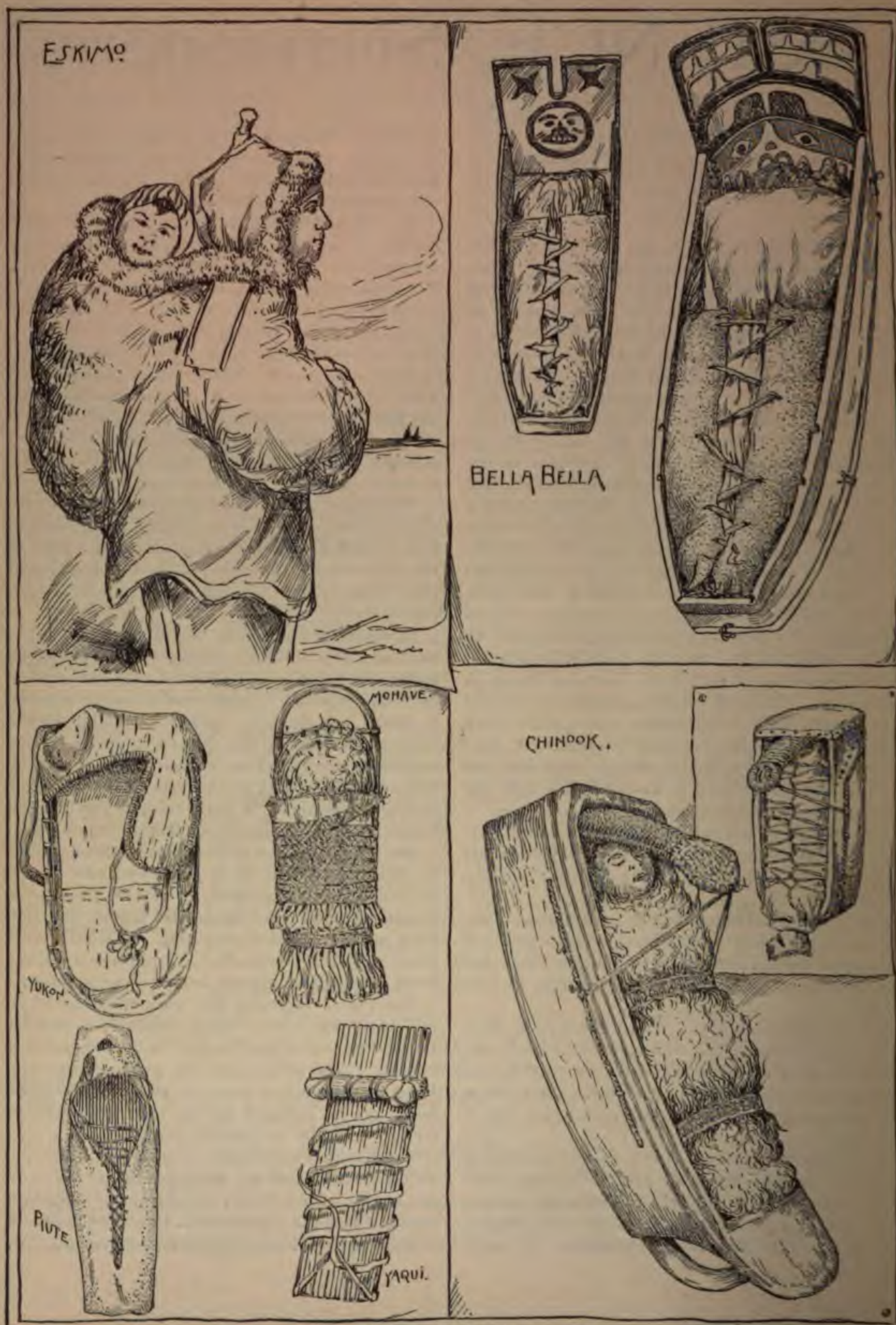
The Hupas and all other Oregonian and northern Californian tribes weave their cradle-baskets and wallets from twigs or from the tough fibre of the milk-weed. In shape, the frame resembles an open slipper, and a pretty dish-shaped awning covers the face.

In southern California the Mohave and other members of the Yuma stock make a ladder or trellis, on which is laid a bed of shredded willow or mezquite bark. A blanket of the same material is spread over the baby, held in place, not by the almost universal lacing, but by a garter-shaped band wrapped round and round 'cradle and baby and all.' This band, in the specimen figured, is braided, not woven, of party-colored threads, the figures suggesting similar ornaments on pottery.

The Yaqui Indians of Sonora make their cradles of reed-canes, held in a plane by rude dowels piercing them transversely in several places. A bundle of split cane forms the pillow, and two little pads or bosses of rags keep the child's head from rolling off laterally. Yaqui crania should be carefully examined for occipital deformation.

The Piutes represent the great Shoshone stock of the interior basin. Their cradle is a rack of twigs, like that of the Yaqui. It is enclosed in a capsule of buckskin, has an awning over the head, and the bed is made of skins. The child's head has no elevated pillow, but is brought in contact with the fur-covered cradle-frame.

The Navajo cradle-board is the type followed by all the Pueblos and by the Apaches as well. A flat board, with awning, side-flaps, and elaborate lacing, forms the groundwork, which the gorgeous Navajo loads down with silver ornaments. Dr.


ESKIMO
BELLA BELLA
MOHAVE.
YUKON.
CHINOOK.
PIUTE
YAQUI.


HUPA.
SIOUX.
ALGONKIN.
NAVAJO

Shufeldt and Dr. Matthews have both studied this cradle carefully with reference to deformation.

The Sioux cradle represents those of all the tribes on the plains of the great west. It is a trellis or rack of four pieces, like a skid or a flower-frame, or a frame on which fur skins are stretched. Two upright pieces nearly contiguous at the foot are spread apart at the top. They are held in place by cross-slats above and below. A strip of buffalo-skin, fur side up, covers this frame. The child lies on this in a sort of hammock between the vertical slats. There is an ample pillow. The enclosing portion is shoe-shaped, made of leather, and strengthened around the face by stiff hide. The child is lashed in by the closing of these leather flaps, which are now for the most part gorgeously adorned with bead-work.

The Algonquin cradle is, like that of the Navajo, a board with stationary padded pillow, ample bed, and cover ornamented with porcupine-quills.

There are no cradles in the national museum from the southern Indians. The squaws that frequent southern cities at present carry their children in shawls or sacks on their backs.

No attempt is here made to touch the literature of the subject, which generally introduces more confusion than knowledge. O. T. MASON.

## *DR. BAIN ON ULTIMATE QUESTIONS OF PHILOSOPHY.*

PROF. ALEXANDER BAIN of Aberdeen is universally regarded as the greatest exponent of the association school of psychology, and for this reason his scattered papers and addresses are carefully read by philosophical students. At the last meeting of the Aristotelian society, he read a paper on the 'Ultimate questions of philosophy,' which is reported as dealing with the philosophical differences of opinion that grow out of the attempts to give reasons for what has to be assumed as being ultimate. At the outset the author illustrated the position that a science may be very debatable in its foundations, and yet the superstructure raised upon these may be sound and unimpeachable. This is most apparent in the mathematical and physical sciences, in several of which the ultimate axioms are given in questionable forms, without impeding the development of truthful doctrines, both inductive and deductive. Less obvious is the application to logic and psychology, which, in the opinion of some, are in a state of total arrest until the fundamentals are thoroughly adjusted. Yet this extreme position may be overstated; for in these sciences many important results have been obtained, while controversy still rages in regard to the primary truths of both. In following out the main design of the paper to deal with ultimate questions, the two foundation axioms of logic, namely, the axiom of self-consistency and the axiom of nature's uniformity, were first considered, the chief stress of the discussion being laid on the second. The absolutely ultimate character of the belief that the future will resemble the past was contrasted with the three other views of the axiom: namely, 1°, that it is an identical proposition (as maintained by Taine and Lewes); 2°, that it is an intuition; 3°, that it is a result of experience. As to the last view, which is the empirical doctrine, the author contended that experience could not assure us of what has not yet happened without making the assumption that the future will be as the past has been, that is, without begging the matter in dispute. The axiom is not properly described either by experience or by faith, and should be treated as unique, and should receive an unmeaning name, that compares it to nothing else. Considering that probably the earliest explicit statement of the axiom is that given in Newton's third rule of philosophizing, there would be no impropriety, but very much the reverse, in this bicentenary year of the 'Principia,' in baptizing it the 'Dictum of Newton.' The author then reviewed the several questions that might be regarded as ultimate in ethics, dwelling especially upon the proper view of disinterested action, which could not be obligatory without ceasing to be disinterested. Finally a search was made in psychology for the best examples of questions of the ultimate class.

## *ASYMMETRY.*

DR. T. G. MORTON of Philadelphia has recently called attention, in the *Medical times* of that city, to the effects of unequal length of the lower limbs in producing lateral spinal curvature. Asymmetry of this kind has been known for some years, but it does not appear that it has been regarded as a cause of ailment in other parts of the body. Dr. Morton finds that it leads to backache of distressing severity, and also that it can be cured by adding to the shoe-heel of the short leg. The following is abstracted from his accounts of several cases: a young man, aged twenty-five, had been troubled for over a year with severe and continued backache, extending to the right side. When attempting to straighten up his back, he experienced a cramp-like feeling. It was found that his right leg was one and five-eighths inches shorter than the left, and that the right arm and leg were smaller than the left. The unsymmetrical form of the body was very apparent in a

back view, but was greatly reduced when the right foot was sufficiently propped up, as in the

Fig. 1.

cuts. The right shoe was then corrected for the deficiency of the leg. With this change, the

Fig. 2.

spinal deformity was nearly rectified, the patient was able to walk without lameness, and the pain in his back entirely disappeared.

## *EDUCATION IN URUGUAY.*

A note in the Journal of the society of arts calls attention to the fact that unusual attention has been given in Uruguay, within the last four or five years, to the education of the masses. The United States chargé d'affaires at Montevideo says that education is now absolved from any denominational inhibition; in fact, the public schools, now over fifty for primary classes, and over one hundred for second grade, besides three public high schools, are open alike to all religious denominations. Of what are termed rustic or rural schools, there are over 170; and the total number of scholars, in 1884, amounted to 27,000. Of private schools, there were 430, having an attendance of about 20,000 pupils. Rudimentary instruction of some sort is compulsory upon all children between the ages of six and fourteen. An educational institution of a peculiar sort has been established and greatly fostered by the government within the last few years. It is called La escuela de artes y oficios, and its principal aim is to afford to the poor boys of the republic an opportunity to learn different trades and professions at the expense of the government. It is conducted upon a military plan, and its expenses are borne by the ministry of war and marine. The education is altogether practical, and the rules and regulations well defined and understood, and these are strictly adhered to. An applicant for admission to this school must be of Uruguayan extraction, and over fourteen years of age at the time of entry. Vaccination is insisted upon. The applicant must be an orphan or his parents in indigent circumstances. His father, mother, or guardian must contract for him in writing that he is to remain for six years absolutely under the control of the principal of the school, with no interference from home or elsewhere. If taken ill, he must be sent to the hospital, and return to the school as soon as able. Military discipline of the strictest kind is observed. To show the proficiency of the institution, it is only necessary to state that the Rivera, a gunboat said to be powerfully built, was constructed entirely by the young workmen in this school, and launched by them. The minister of war and marine, in his last report, alluding to the institution, says that its progress and usefulness are felt more and more from day to day, and that, in addition to the Rivera constructed there, a small steamer, the Pas y Trabagot, has been built, and the steamers General Palleja and General Garibaldi are in course of construction at the school.

The second volume of Appletons' 'Cyclopaedia of American biography' will be ready in a few weeks, and the third will appear in the autumn.

## MILLER'S ESSENTIALS OF PERSPECTIVE.

IN 'Essentials of perspective' Prof. L. W. Miller sets forth in a very attractive manner the principles of this study of representation which has grown to be such a bugbear among artists and draughtsmen.

In his method of treatment, the author has achieved considerable success; for, while pointing out and emphasizing all right principles, he has presented the subject in a purely objective manner, which renders it exceedingly agreeable to the student.

Recognizing Professor Ware of Columbia as a teacher, Professor Miller endeavors to present as much science as the artist ever has occasion to use; and, steering clear of technical treatment and purely theoretical discussion, leading principles are successively developed by the aid of cases of direct application to practical work.

The value of this method is agreeably shown in the chapter on horizons, where the subject is efficiently covered without reference to the geometrical analysis usually involved.

That portion devoted to curvilinear perspective is particularly interesting, from the graphic manner in which the bearings of this somewhat obscure branch are brought out.

The book will find its most valuable place with artists and architectural draughtsmen, and should do much to rescue the study of perspective from the neglect into which it has fallen.

## LA TERRE DES MERVEILLES.

OUR western surveys have been the opportunity of numerous writers abroad. Foreign travellers are very susceptible to the attractions of our exceptional wonders, and devote themselves to Niagara, the Yosemite, the Yellowstone park, and the Colorado Cañon, much after the fashion of historians who write chiefly about kings and battles, and say little about the common people in the dull times of peace and prosperity. But it is still proper enough that great kings and decisive battles, or curious regions where nature has done, or, better yet, is still doing, her most wonderful and peculiar work, should take the most of our attention. This must be so as long as the diamond is prized as a gem. Mr. Leclercq, president of the Royal geographical society of Belgium, is therefore fully warranted in dividing the account of his travels in this country into three volumes; one telling of the trip from the Atlantic to the Rocky Mountains, another given to an overland journey to Mexico, and a third devoted to the Yellowstone national park. The last is very neatly done. It is intelligently written, without undue excitement or exaggeration: it is well illustrated by good woodcuts drawn from photographs, and not from the imagination of the usual Parisian artist, who has so often given free rendering to his home-made conceptions of foreign lands. We should be fortunate if all travellers' stories were as well told.

*Essentials of perspective.* By L. W. MILLER. New York, Scribner. 12°.

*La terre des merveilles.* Par JULES LECLERCQ. Paris, Hachette. 8°.

## LETTERS TO THE EDITOR.

[Continued from p 616.]

### Instinct in the cockroach.

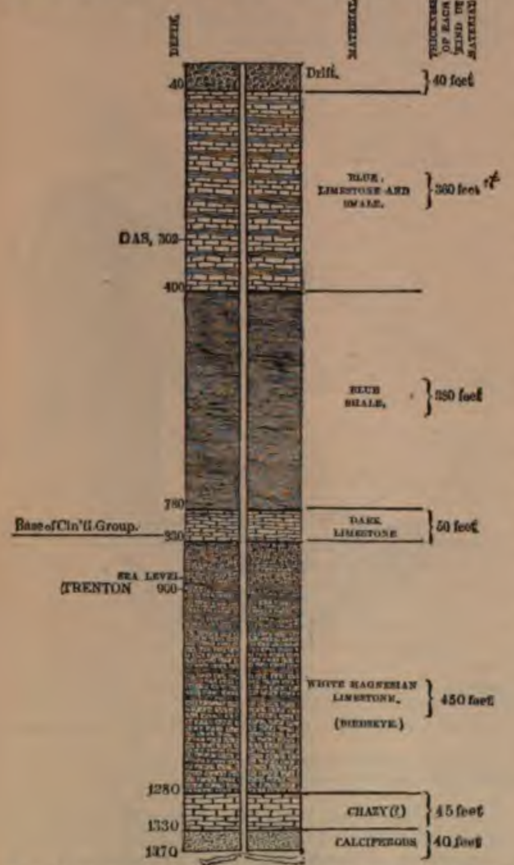
I WISH to bring before the notice of your readers the following curious instance of the operation of instinct in the cockroach (Blatta). During the hot months of the year, my laboratory is to some extent infested by these active insects, and I have been for several years observing their habits. At the distance of two feet above one of the benches, and fixed to the wall, is a double gas-bracket, the outer arm of which is seventeen inches long from the joint to the burner. On more than a dozen occasions, I have observed that a full-grown cockroach would climb up the gas-pipe and along the bracket towards the burner, but, finding the bracket a few inches from the flame too hot to traverse, would crawl back a few inches, wait a second or two, and then return towards the flame. If uninterfered with, he would, after a few trials, leave the bracket altogether, and return down the pipe, and run off at full speed. But I wished to see how he would act under peculiar circumstances. I therefore heated the bracket by the flame of a Bunsen lamp at a point fourteen inches from the tip and three inches from the joint, and waited. The insect, as usual, tried to leave the bracket by walking back towards the wall, but, finding his retreat cut off by the heated metal, became very much excited, and commenced running rapidly between the distal end of the bracket and the part which I had heated. After doing this several times, he selected the coolest part of the bracket, midway between the illuminating flame and the part heated by the Bunsen, crouched for a spring, and leaped on to the bench. He was running off rapidly, when I swept him from the bench, and crushed him on the floor with my boot. The insect deserved to escape, but I killed him because I wanted to observe the action of a fresh cockroach every time under the same circumstances. On more than a dozen occasions has the same performance been gone through. By many people such action would be accounted for by the mere word 'instinct,' but it seems to me singularly like the operation of reason. This is exactly what takes place when a fire occurs in a high building. The inmates (particularly women) jump wildly from the upper windows without waiting to see whether all other means of escape are exhausted — and get smashed on the pavement. Our friend 'the unspeakable Turk' says that women have no souls, and yet, although much higher in organization than the cockroach, they act, in similar circumstances, precisely in the same way.

GEORGE HAY, M.D.

Pittsburg, Penn., June 7.

### Well drilled for gas at Oxford, O.

The accompanying cut represents a section of the strata passed through in a well recently bored in Oxford, O., for the purpose of finding oil or natural gas. A very full series of samples, eighty-seven in number, was saved as the drilling proceeded, and by their means it is possible to give an accurate account of the strata passed through. The drill penetrated the soil and drift to a depth of from forty to fifty feet. Immediately below, the bed-rock was struck. This consisted of layers of solid blue limestone, interstratified with beds of indurated clay or shale at various depths. The rock came up generally in




SECTION OF STRATA PENETRATED BY THE OXFORD GAS AND OIL COMPANY'S WELL.

small, angular fragments, often of the size of peas, sometimes larger, but always recognizable as the true blue limestone of the Cincinnati group. At a depth of 302 feet a small vein of gas was struck. When lighted, the flame was ten or twelve feet high, but it soon went out, accumulating in small quantities, and being lighted from time to time afterwards.

The limestone continued to the depth of 400 feet, and was succeeded by a bed of exceedingly compact, blue shale. This showed no change in character for 380 feet, and it seems to be the equivalent of the Eden shales of the Ohio geological survey. Below this, and at a depth of about 780 feet, there was struck a stratum of hard, dark, almost black limestone, which was penetrated but slowly, the drill making only three feet in two and one-quarter hours. The fragments came to the surface very finely ground up, the pieces seldom as large as wheat-grains. This rock continued for a depth of fifty feet, and it marks the dividing-line between the Cincinnati group and the Trenton. This is the only stratum which can be referred to the Utica slate; and, if it is this, it is 250 feet less in thickness than at Findlay and other places.

The rock immediately below this stratum, reached at 830 feet, is a whitish limestone, evidently foreign to the surface of Ohio. It may be the equivalent of the bird's-eye limestone of New York, as certain specimens show the 'bird's-eye' feature with greater or less distinctness. The rock was much the same, whitish, and containing appreciable quantities of magnesia, down to 1,100 feet. Here it became darker, was more compact, and this continued to 1,280 feet, being alternately lighter and darker in bands. Below 1,280 feet there came another decided change. It was a change from very light to very dark limestone, coarser, with at times a greenish, then a bluish tinge. Some samples had a strong smell of oil, and this could also be readily seen floating on the water. It was also magnesian. This possibly represents the Chazy of New York. At 1,325 feet the drillings were coarse, blue and white, and argillaceous. At 1,330 it was a coarse white rock, but arenaceous; so much so, that the drillers said 'sand!' Each successive drilling, at 1,340, 1,345, 1,350, 1,355, 1,360, 1,365, was finer than before; and when the last depth had been reached, and the drill was withdrawn for pumping, the rope showed the presence of water in what had previously been a dry hole. Soon a strong smell of sulphuretted hydrogen told the story that sulphur-water had been struck, and the drilling was at an end. The last forty feet passed through is in all likelihood the upper portion of the calciferous sand-rock of New York.

The following table represents the formations passed through in the well, with their respective thicknesses: —

| | |
|---|---|
| Drift | 40 feet. |
| Cincinnati group | 790 " |
| Trenton | 495 " |
| Calciferous | 40 " |
| Total | 1,365 feet. |

JOS. F. JAMES.

Oxford, O., June 6.

### Another muscle in birds of taxonomic value.

Whatever laborers in ornithotomy in past times may have done, it is certainly chiefly due to the late and talented British anatomist, Garrod, that certain muscles, and groups of muscles, found to be present or absent in natural divisions of birds, were pressed into service with telling effect in the taxonomy of the class.

There are three principal muscles in the pectoral limb of a bird, or rather in one that possesses them all, which Garrod, by dwelling upon their modifications, their constancy, their various modes of origin and insertion, throughout the group, brought into classificatory play: these are the tensor patagii longus, the tensor patagii brevis, and the 'bicipital slip to the patagium.' He referred to no others especially, in this patagial region, and these three are now sufficiently well known to anatomists to ob-

viate the necessity of my further alluding to them here.

Among my manuscripts in the hands of publishers, I have some very extensive work upon the myology of birds, illustrated by nearly a hundred original drawings; and, as many of my friends are aware, I have been engaged for a number of months past upon my second contribution to the anatomy of the Macrochires, a work now drawing towards completion. Quite recently, while investigating the muscular system of the Hirundinidae, in this latter connection, I discovered, in the course of my dissections, a muscle for which at this moment I recall no published description, and one the importance of which Garrod, even if he knew of its existence, certainly overlooked. When present, its chief carneous portion occurs in the free marginal fold of that triangular duplicature of the common integuments found between the root of the neck and the tip of the shoulder in birds. It first came to my notice in a specimen of Progne subis, whereupon I at once dissected a number of other individuals of the same species; and I found it equally well developed in all of them.

This muscle, in part, is a dermal muscle, and arises from the integuments on the anterior aspect of the neck at about its lower third; at its origin its fibres spread out fan-fashion, their terminal fibres meeting those of the muscle of the opposite side in the median line. Here it is quite adherent to the skin, but its fibres rapidly converge as they pass in the direction of the shoulder-joint, opposite which region they gradually free themselves from the skin to form a small fusiform muscle, which, ending in a delicate tendon, runs along within the free marg
fold of the patagium of the wing, in commo
the tendon of the tensor patagii longus, to blend
it just before arriving at the carpal joint.

Garrod chose the wing of Ramphastos
illustrate the arrangement of the patagial muscle
the Passeres, but not a hint of this one is giv
while in the figure (Icterus vulgaris) next
tendinal slip is shown cut short, of which he
nothing, but which evidently belongs to this mus
Nowhere else is this shown or alluded to in h
work.

I propose to call this muscle the 'dermo-te
patagii,' it being partially connected with the
tegumentary system of muscles in the birds whe
I have thus far found it.



FIG. 1.—VIEW, FROM THE OUTER SIDE, OF THE MUSCLES OF THE PATAGIUM OF THE LEFT WING OF A PASSERI
RHAMPHASTOS CUVIERI (AFTER GARROD, AND SLIGHTLY REDUCED FROM ORIGINAL).

FIG. 2.—SAME VIEW, AND CORRESPONDING PARTS OF THE SAME WING OF A PASSERINE BIRD, PROGNE SUBIS (BY THE
WRITER).

*tp. l.*, tensor patagii longus; *tp. b.*, tensor patagii brevis; *dt. p.*, dermo-tensor patagii; *e. m. r. l.*, extensor
radialis longus; *t.*, triceps; *b.*, biceps; *S. R.*, secondary remiges (fig. 2 nearly × 2).

Upon dissection, I find it present in each
of the other United States Hirundinidae; in all t
passerine birds, including Ampelis; but absent in
Caprimulgi, in the Trochili, in the Cypseli, and
we may judge for all the typical Passeres
myodi from the condition in Tyrannus tyrann
is also wholly absent in them. Further than thi
have not investigated the matter, as my work on
Macrochires prevents; but it will be highly inter
ing, to say nothing of its importance, to look up
subject for other groups of birds. Its importance
once becomes evident by finding it in such a form
Ampelis, showing by this character, at least,
passerine affinities of this bird over its clamat
ones, which latter have been more than once
pected, at different times, as predominating in
organization. R. W. SHUFEL

Fort Wingate, N. Mex., May 24.

# INDEX TO VOLUME IX.

.*. *Names of contributors are printed in small capitals.*

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# SCIENCE





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